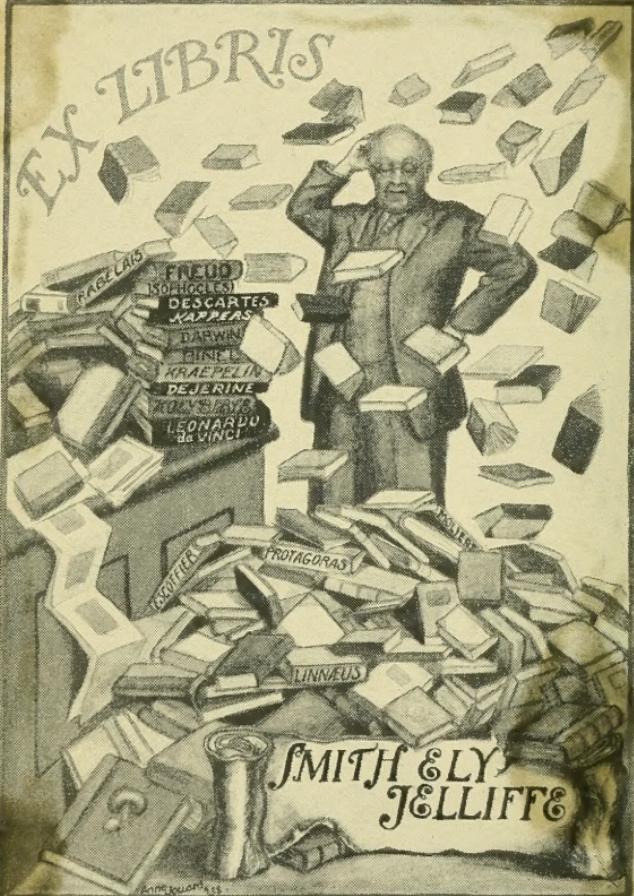


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THE
FOOD FACTOR IN DISEASE

VOL. II.

'Quod est ante pedes nemo spectat: cœli scrutantur plagas.'—ENNUS.

'When circumstantial proof is in its greatest perfection, that is, when it is most abundant in circumstances, it is much superior to positive proof.'—BURKE.

'False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for everyone takes a salutary pleasure in proving their falseness; and when that is done, one path towards error is closed, and the road to truth is often at the same time opened.'—DARWIN.

'La tempérance et le travail sont les deux vrais médecins de l'homme.'

ROUSSEAU.

'Sanguis moderator nervorum.'—HIPPOCRATES.

'I am sick of diseases, I want to know origins and processes . . . the pathology of processes is the work of the future. . . . If we are to prevent disease it is to the beginning of the chain of accumulating stresses that we must look.'

CLIFFORD ALLBUTT.

'I am prepared to maintain . . . that the practitioner is the man who very often plans the coach, and that the function of the worker in the laboratory is to drive in the bolts and put on the varnish. . . . To my mind the function of practice is to throw light on the functional and common ailments. . . . It is in these so-called trivial diseases, the common objects on the medical shore, that our danger comes of sinking into indifference—that is, unto death.'—GOODHART.

'What we need and wait for to-day in medicine is . . . some fundamental and far-reaching generalization in pathology and physiology which would vivify and vitalise some part at least of the mass of dead material facts which have been accumulated.'—CARTER.

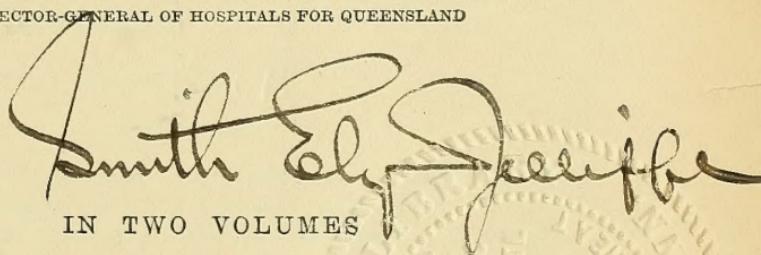
THE FOOD FACTOR IN DISEASE

BEING AN INVESTIGATION INTO
THE HUMORAL CAUSATION, MEANING, MECHANISM, AND RATIONAL
TREATMENT, PREVENTIVE AND CURATIVE, OF THE
PAROXYSMAL NEUROSES (MIGRAINE, ASTHMA, ANGINA PECTORIS
EPILEPSY, ETC.), BILIOUS ATTACKS
GOUT, CATARRHAL AND OTHER AFFECTIONS
HIGH BLOOD-PRESSURE, CIRCULATORY, RENAL AND
OTHER DEGENERATIONS

BY

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Francis Ely De Jeffreys

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ERRATUM

Page 248, line 7 from bottom of page, for 'exanthem' read 'enanthem.'

THE
FOOD FACTOR IN DISEASE

CHAPTER XIV

§§ 582–613

Recurrent hyperpyraemia; or hyperpyraemia interrupted by recurrent pathological acarbonizing processes, depending on hyperpyraemia (*cont.*)—Acute gout—Evidence that acute gout depends upon hyperpyraemia : food : variations in the rate of combustion : rhythmic fluctuations in combustion and carbon contents : fat-formation : haemorrhage : plumbism : glycosuria : paroxysmal neuroses : pathological states promoting acarbonization complexly : self-curative effect of acute gout : pyrexia : gouty dyspepsia : dietetic treatment—*Rôle* of uric acid in acute gout—Visceral gout—Factors in gout other than hyperpyraemia and retention of uric acid : factors in uricaemia other than hyperpyraemia : negative factors in gout—Summary.

ACUTE GOUT

§ 582. Fagge says:¹—‘In considering the theory of gout, we must start from the fact that the blood in this disease contains an excess of uric acid.’ Now that is what most pathologists have been doing since Garrod’s demonstration ; but few, I think, will claim that any substantial advance towards elucidating the mystery of gout has since been made. To me it seems that, by continuing to start at the point indicated, we run a serious risk of never getting behind the excess of uric acid in the blood ; and that our failure hitherto in this respect is an example typical of the failure of the exclusively inductive method of investigation, so long in fashion, and of the teaching which leads us to magnify a single experimentally demonstrated

¹ *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 673.

fact out of all proportion to the inferences which may be drawn from general principles.

But many physicians are commencing to take a wider view of gout. Ewart says :¹—‘Gout is made up of . . . something concerning which we would like to know more than we do, and, in the second place, of the uric acid complication.’ Roberts² says that uric acid does not ‘cover the whole field of gout,’ and that, ‘if uric acid were altogether eliminated, a pathological entity would still remain and be recognizable as gout.’ Bouchard says:—‘It has by no means been demonstrated that in gout uric acid is the only, or even the chief, matter contaminating the fluids.’ And Burney Yeo³ concludes that ‘the true pathogeny of gout must be sought for in some disturbance of function *antecedent* to the accumulation of urates in the blood, which accumulation occurs in other diseases besides gout.’ (Italics mine.)

In this chapter, I propose to start from what I believe to be the missing factor in gout, the hypothetic condition of hyperpyraemia : to try and show that, as with some paroxysmal neuroses and other affections, hyperpyraemia constitutes an early and essential factor in causation ; and to demonstrate that the paroxysm itself is a conservative acarbonizing process.

It seems probable that the hyperpyraemia which constitutes the fundamental humoral factor of many of the frequently recurring paroxysmal neuroses consists of a mere quantitative increase in the normal carbon contents of the blood (§ 195). But it is unnecessary to assume that the hyperpyraemia which constitutes the fundamental humoral factor of articular gout has the same chemical constitution. Acute articular gout, I shall argue, is an infrequent acarbonizing process, depending on a comparatively prolonged hyperpyraemia (§ 607). Hence, as already suggested (§ 196), the chemical constitution of the hyperpyraemic load may be comparatively complex. All we can say is that it is carbonaceous and therefore subject to the laws of carbonaceous metabolism (compare also remarks on Case LVIII).

¹ *Gout and Goutiness*, 1896, Ewart, p. 3.

² Quoted by Burney Yeo, *British Medical Journal*, June 15, 1901. ³ *Ib.*

EVIDENCE THAT ACUTE GOUT DEPENDS UPON HYPERPYRAEMIA

§ 583. The evidence under this head may be generalized as in the case of the paroxysmal neuroses : conditions tending to cause hyperpyraemia tend to initiate or precipitate, conditions tending to cause acarbonization to defer or abolish, gouty paroxysms. These conditions will now be considered in some detail.

§ 584. FOOD.—Theoretically, the diet most certain to lead to hyperpyraemia would contain proteid in amount sufficient to maintain the carbonizing functions of the digestive organs in a state of high efficiency, together with carbonaceous material in excess of the capacities of the tissues for physiological acarbonization : such would constitute a heavy mixed diet. Conformably, Woods-Hutchinson says :¹—‘ An excess of starches and sugars in conjunction with a moderate amount of nitrogenous elements in the diet will promptly produce gout in susceptible subjects ’ ; and he points out that, amongst the lower animals, the only mammal in which gout occurs is the omnivorous pig.

The same author says :²—‘ The two substances which are clinically recognized as being by far the most active and constant elements in the production of gout and goutiness are not even nitrogenous bodies but pure carbohydrates, alcohol and the fruit sugars.’ And ‘ Scudamore³ mentions the case of a gentleman, free from hereditary tendency and with no reason to suspect that he would be attacked, who was seized with gout for the first time after three or four days’ excessive conviviality.’ The influence of alcohol *per se* in predisposing to gout is disputed ; but Bristowe⁴ believes that even pure alcohol is injurious in gout ; and alcohol has been shown to retard combustion (§ 209). But all are agreed that certain alcoholic liquors are especially harmful : these are mainly such as contain carbohydrates. Malt liquors, especially if strong, are condemned by all : port wine containing glucose, the variety of sugar which requires least peptic change for absorption, is notoriously the worst of all alcoholic stimulants ; and it has already been pointed out that alcohol increases the absorption of sugar from

¹ ‘ The Meaning of Uric Acid and the Urates,’ *Lancet*, January 31, 1903, p.290.

² *Ib.* ³ *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 674.

⁴ *Theory and Practice of Medicine*, 1884, p. 888.

the stomach (§ 209). We may believe that, on account of their more facile absorption, sugars of all kinds are more injurious to the gouty than starches, a conclusion which has been arrived at empirically.

Sydenham said :¹—‘Gout attacks such old men as, after passing the best part of their life in ease and comfort, indulging freely in high living, wine, and other generous drinks, at length from inactivity, the usual attendant of advanced life, have left off altogether the bodily exercises of their youth.’ And Ewart says :²—‘The broad conclusions to be drawn from Sydenham’s observations are that the failure of the digesting and assimilating functions arises from their inadequacy to deal with the relative surfeit of food.’ From the standpoint of this work, the failure of assimilation is one important cause of hyperpyraemia and therefore of gout; but the failure of digestion, so often observed in the gouty, cannot, as I shall argue, be regarded as a factor: it must be regarded as a conservative device, an attempt—often unsuccessful, it is true—to avert hyperpyraemia; and gout must be regarded as arising in spite, not in consequence, thereof. Indeed, as already stated (§ 49), Ewart himself considers that gout is commonly acquired by the aid of a sound stomach.

§ 585. VARIATIONS IN THE RATE OF COMBUSTION.—Cold bathing powerfully stimulates combustion; and we may perhaps infer that hot bathing has an opposite effect, though this is denied by some. At any rate, when it was customary at hydropathic establishments to submit sufferers from gout to prolonged hot bathing, an acute arthritic seizure was often induced³ (Oliver). Much general improvement followed, and this was attributed to the bathing, which was of course indirectly responsible. Hyde of Buxton informs me that acute attacks are not infrequently induced by hot bathing at the present day, though the baths are much shorter and cooler than of old. Bannatyne holds similar views, though he expresses them somewhat cautiously. Referring to the fact that the first effect of spa treatment may be to bring on an acute gouty paroxysm, he says :⁴—‘It is held that this gouty

¹ *Works of Sydenham*, Syd. Soc., vol. ii. p. 123.

² *Gout and Goutiness*, 1896, p. 524.

³ Oliver, quoted by Haig: *Uric Acid in Disease*, 1897, p. 517.

⁴ ‘Balneological Treatment of Gout,’ Gilbert A. Bannatyne, *Practitioner*, July 1903, p. 116.

paroxysm is brought about by the presence of sodium or its salts in the mineral waters drunk, but I have more than a suspicion that these acute attacks are brought on more by the thermal action of the mineral waters, when used externally, than by the action of any of their chemical constituents. . . . I cannot call to mind any case that developed an acute attack on drinking the waters only, whereas I can remember several which came on only from bathing, the bath being either a simple warm immersion or a vapour bath. Of course these attacks may have been coincidences, but I have seen them apparently determined by plain hot-water baths in those who were having no mineral water treatment at all.' Garrod says: ¹—'I have seen a severe attack of gout brought on by taking a hot bath soon after dinner': here, of course, two causes at least, both tending to hyperpyraemia, were in operation simultaneously. And Henry Rayner, speaking of a stuporous lunatic with suppressed gout, says: ²—'Hot air-baths were given with great benefit . . . under their use, he soon developed severe acute attacks of gout and convalesced rapidly.'

Muscular exertion, we have seen, greatly increases combustion, and, when combined with life in the open, is the great preventive of gout and goutiness. But exercise has been known to avert a paroxysm which was actually impending, and even to disperse a fully developed attack. Balfour ³ quotes the statement of many writers that a threatened attack may be warded off by exercise: Duckworth says: ⁴—'A strong man, feeling an acute paroxysm impending, determines to fight down his gout, and forthwith steps out briskly for a few miles, and walks off the attack'; and Cullen recorded the case of a man, confined to bed with gout, who rose and ran as fast as he could when he heard his neighbour's house was on fire, and was quickly cured. Sydenham said: ⁵—'The omission of any customary exercise brings it on,' and 'whenever I returned to my studies, gout returned to me.'

Fothergill says: ⁶—'Voluntary indolence is a well-recognized

¹ *Gout and Rheumatic Gout*, 1876, p. 246.

² *Dictionary of Psychological Medicine*, Hack Tuke, 1892, vol. i. art. 'Gout and Insanity.'

³ *Lancet*, August 13, 1892.

⁴ *Treatise on Gout*, 1890, pp. 348, 349.

⁵ *Works of Sydenham*, Syd. Soc., 1850, vol. ii. p. 123.

⁶ *Gout in its Protean Aspects*, 1883, pp. 163, 164.

factor of gout. But enforced indolence is less generally familiar. Yet, when a person with a tendency to gout is incapacitated from taking his wonted exercise, he rapidly becomes the subject of gout, unless . . . he alters his dietary accordingly. Thus gout in the lower limbs carries with it a worse outlook than gout in the hands, because it cripples the individual as regards the taking of exercise. Coachmen, who are liable to gout in the hands, commonly remain hale as regards their general health; while butlers, who usually have gout in their feet, have a decided tendency to go on from bad to worse.¹ He gives several instances in which accidents precluding accustomed exercise led to a first attack of gout. He also mentions, on the authority of Van Swieten, an example of the cure of gout by enforced exercise. ‘A rich gouty old priest was taken captive by the pirates of Barbary, who kept him hard at work as a galley-slave with little to eat. He soon lost his gout.’

We have seen that enforced indolence frequently initiates or aggravates the attacks of other pathological acarbonizing processes depending on hyperpyraemia (§ 303); and it would have been easy to show that enforced exercise has an opposite influence.

§ 586. RHYTHMIC FLUCTUATIONS IN COMBUSTION AND CARBON CONTENTS.—The acute gouty outbreak, like the paroxysmal neuroses, occurs most commonly in the small hours of the morning (2 A.M., Sydenham, 1 to 4 A.M., Ewart) at the time when katabolic decarbonization is falling or low. Food taken during the time that combustion is on the downward grade would, we can easily understand, tend strongly to cause hyperpyraemia; and Sydenham¹ said ‘as to meal-times, it is best not to take supper.’ The fact that gout especially favours the late winter and early spring months may perhaps be explained by the extra eating and comparative confinement to the house during an English winter.

§ 587. FAT-FORMATION.—It often happens that gout disappears temporarily, not rarely even permanently, from an erstwhile meagre patient, who, as the result of change of air or other tonic influence, has increased his capacity to construct fat. But the salutary influence of fat-formation has not been fully realized: as already pointed out, we have been inclined

¹ *Works of Sydenham*, Syd. Soc., 1850, vol. ii. p. 142.

to regard increased fat-formation as a mere index of convalescence, rather than as a factor in the process. Hence it is not easy to find recorded cases in which gout has been superseded by obesity. Savill,¹ however, records a typical case: the patient had suffered severely in past years from gout in both feet, but he became obese (20 stone 4½ lbs.) and thereafter ceased to suffer from the arthritic affection; and I feel sure that most physicians will be able to recall similar cases—cases which seemed to have no special significance at the time. At least, I myself can remember more than one in which the permanent disappearance of recurrent arthritic gout was ascribed to some special medicine, but in which I am now confident the main curative factor was an improved power of fat-construction leading to obesity.

The frequent association of obesity and gout in the same family (noted by many authors, Laycock, Bouchard, Charcot, and others), and in the same individual, is thus susceptible of a simple explanation. Both affections depend primarily upon the presence in the circulation of carbonaceous material or fuel in excess of the requirements of the organism. In obesity, the excess is disposed of physiologically by exaggerated anabolic decarbonization: hence hyperpyraemia is averted. In gout, physiological decarbonization is inadequate: hence hyperpyraemia arises and is dispersed by the recurrent pathological acarbonization of pyrexia.

Harry Campbell² points out that a well-known public man who quite recently boasted that he never takes any exercise is indeed a martyr to gout. Deficient exercise is undoubtedly a factor in gout; but its influence is apt to be restrained by the existence of a well-developed fat-forming capacity, which, if I mistake not, is absent in the public man referred to.

It seems to me that, in the following expression of his opinion, Fothergill³ pays an unconscious tribute to the salutary influence of a well-developed fat-forming capacity on gouty affections. ‘In the broad square subjects of gout, malt liquors may be taken in moderate quantities without much injury; . . . while in those of thin flank . . . malt liquors are ever injurious.’

§ 588. HAEMORRHAGE.—As has been already argued, the

¹ *Lancet*, 1893, vol. ii. pp. 133 *et seq.*

³ *Gout in its Protean Aspects*, 1883, p. 163.

² *Headache*, 1894, p. 322.

two epochs in woman's life at which hyperpyraemia is most likely to arise are puberty and the menopause ; and Tilt¹ says that ' women are most liable to gout at puberty and the change of life.' In support, he gives a table from the Registrar-General's Reports, which shows that the mortality curve of gout in women attains two apices, one between the ages of 10 and 15, the other between the ages of 40 and 50. In males, on the other hand, there was no mortality below the age of 15 ; and the mortality goes on increasing thenceforward up to the age of 60. In the female sex again, ' puberty sweeps away the tendency ' to gout for a time, for there is no mortality from this affection between 15 and 20 (Tilt).

Garrod² says, gout in women is ' most liable to arise shortly after the cessation of the menstrual discharge ' (menopause).

In women, during the reproductive period, hyperpyraemia, we have seen, is most prone to occur just before menstruation (§ 156) ; and the tendency to hyperpyraemia will be increased, should anything intervene to prevent the acarbonizing flow. Hippocrates said :³—' Mulier podagrâ non laborat nisi ipsi menstrua defecerint.' This Garrod does not regard as absolutely true at the present time, but he admits that ' it is⁴ not uncommon to find the suppression of an ordinary discharge of blood, as the sudden stoppage of the catamenia, immediately followed by a paroxysm. M. Duringe relates the case of a lady in whom the cessation of the catamenia, caused by a violent fright, was followed by several attacks of gout, which ceased when the patient again became regular. Cases illustrative of the effect of the suppression of an habitual haemorrhoidal discharge are by no means uncommon.' The inverse correlation between menstruation and articular gout will be again considered (§ 608).

Consistently, ' Celsus⁵ about the beginning of the Christian era, in speaking of the treatment of gout, remarked that bleeding at the commencement of the attack had the effect of causing some patients to be free from the disease for a year, some even for life.'

Garrod, however, refers to cases in which a first fit of gout immediately followed haematemesis, epistaxis, and other forms

¹ *Change of Life*, 1882, p. 287.

² *Gout and Rheumatic Gout*, Garrod, 1876, p. 212.

³ *Ib.*

⁴ *Ib.* p. 248.

⁵ *Ib.* p. 5.

of haemorrhage. In such cases, it seems highly probable that the haemorrhages and the gouty attacks were co-results of the same blood-state—simultaneous, or nearly simultaneous, explosions (so to speak) of the hyperpyraemia. We are encouraged in this view by the fact that the haemorrhages in question were, for the most part, ‘spontaneous’ haemorrhages. And later I shall argue that many forms of idiopathic haemorrhage depend upon hyperpyraemia, and may be regarded as conservative acarbonizing processes (§§ 668 *et seq.*).

§ 589. PLUMBISM.—It has been argued that plumbism is capable of leading to hyperpyraemia (§ 232); and it has long been known that persons affected with this form of poisoning are much more liable to gout than others. Garrod found that, of his hospital patients affected with gout, ‘from 25 to 30 per cent. had previously been affected either with lead colic or paralysis, or at least exhibited very strongly the characteristic blue line upon the gums.’¹ He also saw several cases in which ‘the medical administration of lead salts caused severe attacks of gout in patients who had previously suffered from the disease’;² and the attacks recurred so frequently, whenever the medicine was renewed, that there could be no doubt as to the relation of cause and effect. The association between lead poisoning and gout had previously been noticed by Musgrave, Huxham, Falconer, Parry, and Todd.³

§ 590. GLYCOSURIA.—As with the paroxysmal neuroses, so with gout, the onset of glycosuria or diabetes may put an end to the paroxysms. Garrod says:⁴—‘In several instances of patients who had for many years been subject to periodic gouty attacks, the supervention of diabetes has entirely prevented its recurrence; and in others it has lengthened the intervals very considerably.’ He instances the following case: ‘A gentleman, about 60 years old, had had at first yearly, then half-yearly, attacks of gout in the feet for about twelve years: diabetes then suddenly came on, and for more than four years he remained quite free from all gouty symptoms; the diabetes was afterwards checked, the specific gravity of the urine being reduced from 1·041 to 1·021, and soon afterwards slight gout followed on an attack of bronchitis. I might quote several other cases bearing on the same fact.’

¹ *Gout and Rheumatic Gout*, Garrod, 1876, p. 475.

³ *Ib.* p. 237.

² *Ib.* p. 243.

⁴ *Ib.* pp. 472, 473.

The alternation between arthritic gout and glycosuria was observed by Claude Bernard, Rousseau,¹ and Charcot.² It is readily understood on the view that glycosuria is an acarbonizing process.

§ 591. PAROXYSMAL NEUROSES. — The inverse relations between acute gout and the paroxysmal neuroses have been observed by a long series of physicians, amongst whom were Fordyce, Labarraque, Henry Holland, Scudamore, Rousseau, Todd, and Liveing.³ Tissot refers to the relation between gout and migraine ‘as a matter of general observation’ (Liveing):⁴ Rousseau regarded the two affections as ‘twin sisters’; though this is considered an exaggeration by Gowers. This difference of opinion is easily reconcilable on the hyperpyraemic theory. Both gout and migraine depend upon hyperpyraemia and are pathological acarbonizing processes: their affinity consists in a community of causation and a community of effect: hence it would be difficult to *exaggerate* their *pathological* affinity. But, inasmuch as both affections own peculiar secondary factors, they may be said to constitute pathological acarbonizing capacities of different individuals: herein consists their antagonism: hence it would be easy to *exaggerate* their *clinical* affinity. Nevertheless, it may happen, as we have seen, that some individuals, owing to a less common combination of secondary factors, become endowed with, and exhibit, both pathological capacities at different periods of their life history.

Gout has identical relations with recurrent biliary attacks, not typically migrainous and not prominently nervous in character. The relationship of gout to angina pectoris, epilepsy, and migraine, has recently been investigated by Kovalesky⁵ of St. Petersburg. Rousseau⁶ refers to an apothecary ‘in whom attacks of asthma periodically alternated with attacks of articular gout. The thoracic symptoms recurred during two or three months without the supervention of any affection of the joints: they then occurred, when the asthmatic attacks ceased.’

It is not easy to be sure what is the first step which, in any

¹ Rousseau’s *Clinical Medicine*, New Syd. Soc., vol. iii. p. 497.

² *Lectures on Senile Diseases*, Charcot, New Syd. Soc., p. 100 *et seq.*

³ *Megrin and Sick-headache*, Ed. Liveing, 1873, p. 400. ⁴ *Ib.*

⁵ *Bulletin de l’Académie Royale de Médecine de Belgique*, September 27, 1902.

⁶ *Clinical Medicine*, New Syd. Soc., vol. iv. p. 380.

individual case, occurs in the replacement of an accustomed paroxysmal neurosis by acute gout, or in the converse change. When some long-recurrent acarbonizing neurosis, such as migraine or asthma, ceases, and acute gout continues to recur thenceforward, the explanation which immediately suggests itself is that the neurosis has been dispersed by the arthritic pyrexia, just as it is liable to be dispersed by any other pyrexia such as typhoid. But, on further consideration, such explanation seems inadequate. For I am arguing that acute gout itself depends upon hyperpyraemia; and later we shall see reason to think that the anteceding hyperpyraemia of gout is of a certain duration (§ 607). Consequently, the question arises: How has the gout arisen in the face of the frequent anteceding neurosal acarbonization? We are next impelled to consider whether the initial step in the change from a frequently recurring neurosis to the less frequently recurring arthritis is not a cessation of the neurosis through a failure of some secondary factor essential thereto. Such cessation may occur in migraine through correction of ametropia, in asthma through intra-nasal interference or from change of atmospheric conditions. In both cases, the resulting loss of frequently recurring neurosal acarbonization would conduce to the more prolonged hyperpyraemia which seems essential for the development of arthritic gout; and, in the latter case at least (§ 573), arthritic gout has been known to develop. Furthermore, arthritic gout having developed, the associated pyrexial acarbonization—more prolonged and therefore, if only for this reason, more efficient—would be protective for a time against a return of the hyperpyraemic neurosis. But the most coherent assumption—the assumption which seems most consistent with all the facts in most cases—is that the anteceding neurosis was physiologically prepotent and, moreover, inadequate as an acarbonizing process (compare § 569). On this view, the accumulation which led to the hyperpyraemia and consequent acarbonizing paroxysm of arthritic gout would have been continuous, though remittent; and the arthritic gout would act by introducing into the accumulation a true intermission.

On the other hand, when recurrent arthritic gout ceases and some frequently recurring neurosis supervenes, it may be either that some essential secondary factor, hitherto lacking, has

intervened and determined the neurosis, or that some essential secondary factor of gout, such as the introduction of uric acid-forming material, has failed. In both cases, the succeeding neurosis, if an efficiently acarbonizing process, would tend to prevent a recurrence of the arthritis.

The phenomena of retrocedent gout—visceral paroxysmal affections suddenly arising on the premature suppression of acute or subacute gout—are, as will presently be mentioned, in many cases closely imitative of, if not identical with, the various paroxysmal neuroses; and it is open for us to regard such affections as hybrids between gouty pyrexial and neurosal acarbonization.

§ 592. PATHOLOGICAL STATES PROMOTING ACARBONIZATION COMPLEXLY.—Many pathological states, which we may suppose for numerous reasons are hostile to hyperpyraemia, have been observed to alternate distinctly with articular gout. Tilt¹ refers to a clearly illustrative case. A married woman of 40 had gradually become delicate, having suffered from dyspepsia, constipation, and occasional attacks of gout, chiefly in her wrists and fingers, which however had caused less inconvenience within the last two years. She had also a severe ulcerated condition of the uterus with induration and enlargement. Local and general treatment resulted within three months in the complete cure of the uterine affection. ‘The sequel of the case, however,’ adds Tilt,² ‘bears a moral. She had scarcely been restored to what was to her, comparatively speaking, crude health, when the gout, which had, throughout her uterine attack, been nearly suppressed, . . . again threatened her, but with more determination than formerly. Not merely her fingers and wrists, her knees and her ankles and feet were successively and severely attacked, assuming the mixed gouty rheumatic character; and when I last saw her, at an interval of some years, the fingers of both hands were fixed: she had chalk stones and contracted joints, her knees and ankles permanently enlarged and fixed—yet the uterine inflammation and ulcer never returned.’

§ 593. THE SELF-CURATIVE EFFECT OF ACUTE GOUT: PYREXIA.—It has been already argued that acute gout is a recurrent pyrexial acarbonizing process (§ 279); and if, as I am now attempting to show, gout depends upon hyperpyraemia, then it is

¹ Tilt, *On Uterine Therapeutics*, 1878, p. 291.

² *Ib.* p. 292.

easy to understand why and how, as Mead long ago said, ‘gout is the cure of gout.’ The acarbonization resulting from the attack explains, too, ‘why there should be, after an articular seizure, a total or permanent cessation from those symptoms which are supposed to depend upon impurity of the blood,’¹ and which Ewart regards as at present inexplicable; for, as I shall argue later, the symptoms referred to—that is to say, the symptoms of irregular or abarticular gout—depend upon, and are manifestations of, hyperpyraemia (§ 858).

That the pyrexia is the salutary factor—that, in the words of Laycock, gout is an ‘excretory fever’²—is further assured by the well-recognized fact that ‘the³ relief that fails to be secured through the paroxysms of acute gout is sometimes attained through the intervention of other acute inflammatory attacks, which often appear to exhibit a truly substitutive character. In this way, various acute febrile diseases and inflammations, like tonsillitis, bronchitis, rheumatism . . . afford great relief from the constitutional symptoms of arthritism. The beneficial effects of such maladies are undoubtedly due to the increased activity of the process of oxidation and elimination that accompanies their course’ (Henry M. Lyman).

Perhaps the most striking instance of the salutary influence of an intercurrent pyrexia upon the gouty process is found with the moderate septic pyrexia, associated with the suppuration, which sometimes occurs in old gouty deposits. Garrod says:⁴ ‘I have seen many abscesses formed around gouty nodules, which have given exit to a large amount of pus, as well as urate of soda, on being punctured; this has especially occurred in patients in a weak state of health. It not uncommonly happens, that when patients are suffering from these abscesses, which are keeping up a constant discharge of matter, they enjoy a comparative immunity from active gout; and I have known several instances in which the healing of these abscesses was followed by a sharp attack of gout in some other part of the body, showing that the ulcers had acted as a kind of safety-valve.’ Fothergill, who quotes this passage, ascribes the salutary influence of the suppuration to the discharge of urates from the gouty abscess; but there can be no reasonable doubt

¹ *Gout and Goutiness*, Ewart, 1896, p. 230.

² *Treatise on Gout*, Duckworth, 1890, p. 3.

³ Henry M. Lyman, Pepper’s *American Text-book of Medicine*, vol. ii. p. 140.

⁴ Quoted by J. M. Fothergill, *Gout in its Protean Aspects*, 1883, pp. 156, 157.

that the pyrexia is the main salutary agent. For pyrexia of any kind, even the mild septic pyrexia due to the suppuration in the track of a seton, is, as pointed out in many parts of this work, capable of dispersing many hyperpyraemic manifestations, of which acute gout is but one.

The conservative influence of acute gout has been long recognized. Fothergill says:—‘Articular gout does not cut short life, indeed is linked rather with length of days.’ Sydenham said :¹—‘The fits, that seem so important in the eyes of the hasty, are nothing more than the series and order of symptoms which Nature uses in the expulsion of the morbific matter. Hence to use any medicine for a time is a waste of labour. . . . Again,² just as the fury and sharpness of the fit is beaten back, the longer will the fit become ; and not only that, but the space between the fits will be shorter, as well as less free from every degree of those symptoms which give so much deadliness to this disease. No one, who has well weighed what I have elsewhere exhibited in the history of the ailment in question, will deny this.’ These passages from Sydenham may, with advantage to the theory of hyperpyraemia, be placed alongside passages already quoted from Hyde Salter, James W. Russell, and Henry Holland,—passages, which have an identical significance, but which refer to asthma, migraine, and epilepsy respectively (§ 338).

Trousseau says :³—‘Without adopting the theoretical views of Sydenham, without even being able to form a satisfactory opinion as to the nature of gout, my personal experience leads me to pursue a course as reserved as that recommended by Sydenham. During the last thirty years, I have treated a large number of gouty patients. At the commencement of my practice, like many others, I attempted to fight with the disease : now, I cross my arms, and look on : I do nothing—absolutely nothing—to subdue attacks of acute gout, particularly when they occur in individuals in the prime of life. More than once I have had occasion to regret departing from this do-nothing system, and been led to realize how perilous the adoption of active treatment might become. When, strong in my conviction, I have left the malady to itself; when the patient has resigned himself to suffer, I have always seen him

¹ *Works of Sydenham*, Syd. Soc., vol. ii. pp. 140, 141.

² *Ib.* p. 151.

³ *Clinical Medicine*, New Syd. Soc., vol. iv. pp. 397, 398.

emerge from the crisis in the best conditions ; and thus, at the cost of some suffering, I have purchased for my patients months of perfect health. When, on the contrary, I have interfered with the paroxysm, which, unfortunately, is easily done . . . I ran the great risk of seeing the attacks recur at shorter intervals, and of transforming a frank and transitory gout into a cold, atonic, persistent gout.'

§ 594. GOUTY DYSPEPSIA.—Dyspepsia, 'accompanied with sluggish circulation in the portal system and congested liver,' is, according to Garrod,¹ common in gouty subjects. The most prominent symptoms are, 'heartburn² and eructations, oppression, and frequent sleepiness after food: a feeling of distension in the epigastrium, at times accompanied with tenderness : some fulness over the hepatic region, the edge of the liver projecting a little below the ribs, and being occasionally tender to the touch : the tongue much furred, red at the tip and edges, a disagreeable and clammy taste in the mouth, and the saliva and buccal secretion often more adhesive than natural. The bowels are usually confined, the actions scybalous, sometimes very dark in appearance, at other times light and clay-coloured, indicating either a retention of bile in the gall-bladder, or a defective biliary secretion' (Garrod). Duckworth³ also points out that there may be a deficiency of bile in the motions during the early stages of acute gout. B. London says :⁴—'With few exceptions, my gouty patients, during the acute attack, presented a transitory hepatic enlargement. Palpation of the liver was painful, and disturbance in the secretion of the bile often present.' Ewart says :⁵—'A slight hepatic congestion accompanies the acute gouty attack: this has been noted by most observers.' Again :—'In many gouty subjects, this congested condition of the portal system is so marked, and the relief afforded by the administration of medicines which act on the liver and bowels so great, that some physicians have come to the conclusion that gout is essentially connected with such disturbance; this, however, is erroneous, for in many of the *most severe* instances of gout no such disturbance of the portal system can be discovered, and it is certain that the blood may be brought into a gouty

¹ *Gout and Rheumatic Gout*, 1876, p. 231.

² *Ib.* p. 232.

³ *Treatise on Gout*, 1890, p. 41.

⁴ 'Treatment of Gout at Carlsbad,' B. London, *Practitioner*, Aug. 1903, p. 175.

⁵ *Gout and Goutiness*, 1896, p. 223.

condition from causes in no way connected with the biliary function of the liver.'

The theory of hyperpyraemia enables us to arrange in their proper order these heterogeneous, but associated, morbid phenomena. The enlargement of the liver is by glycogenic distension which, I have argued, is, in so many cases, an index of hyperpyraemia (§ 92 *et seq.*) ; and the dyspeptic manifestations are secondary thereto. These gastro-hepatic phenomena constitute in many cases 'the¹ special prodromata which announce the approaching fit' (Charcot) of gout. In other cases they are long antecedent to the arthritic paroxysm: they may indeed fill in much of the interval between two paroxysms. But in no case, even when they are limited to the immediately pre-paroxysmal period, can the hepatic enlargement, or the dyspepsia, be regarded as, in any way, causative of the gouty paroxysm. They simply own with it a common factor in hyperpyraemia ; and they may be looked upon as unsuccessful protests against hyperpyraemia. Hence, as may perhaps be inferred from the paragraph above quoted from Ewart, cases of gout, unattended by such gastro-hepatic attempts at acarbonization, are apt to be unusually severe. I have elsewhere called attention to the same etiological confusion having arisen in connexion with migraine, asthma, and some dermatoses (§§ 49 to 52). In many cases of migraine, asthma, and epilepsy, the paroxysms are preceded, or ushered in, by gastro-hepatic phenomena which disappear thereafter. From this it is often inferred that, in such cases, the gastro-hepatic condition is the exciting factor of the neurosal paroxysm. But the alternative view, that the gastro-hepatic and neurosal phenomena do not stand to each other as cause and effect, but are both dependent on the one cause, is equally consistent with the existence of these complicated cases. It is, moreover, the only view which is consistent with the existence of cases in which the paroxysms of migraine, asthma, and epilepsy occur without the antecedence of gastro-hepatic phenomena ; and with the observation that such unannounced paroxysms are not rarely extremely severe. We have further proof of the nature of these gastric and hepatic phenomena in the fact that the gouty pyrexia completely disperses them, doubtless by relieving the glycogenic block and the hyperpyraemia upon

¹ *Lectures on Senile Diseases*, Charcot, New Syd. Soc., p. 71.

which the glycogenic block depends. On this point, Charcot says: ¹—‘An individual, long dyspeptic, suddenly experiences an attack of gout; and lo! he is cured of his dyspepsia, at least apparently; but, the joint symptoms once more quiet, the stomach becomes affected again as before.’ Consistent with this view is the opinion of Fothergill already quoted (§ 49) that often, if the patient could be rendered dyspeptic, he would be cured of his gout, for dyspepsia would relieve him from the consequences of too much good living.

§ 595. It has been argued that the glycogenic distension of the liver, which is one index of hyperpyraemia and which is apt to precede, or accompany, so many different pathological acarbonizing processes, causes mechanical congestion or stasis in the digestive mucosae; and that such congestion is peculiarly prone, under slight excitation, to pass into catarrhal inflammation (§ 89). Now it would hardly be surprising if such catarrhal inflammation were at times to extend into some of the glandular ducts which pour their secretion into the alimentary canal. Conformably with this anticipation, it is interesting, and perhaps significant, to note the condition of the intestinal tract and pancreatic duct found in a post-mortem examination on a cock which had died from an attack of acute gout. ‘The pancreatic duct was filled by catarrhal products derived from the lining membrane. This was well seen in a transverse section of the gland at the hilum and also in a longitudinal section. The vessels in the wall of the duct were much distended and also the vessels around. . . . The condition of the pancreatic duct is a very striking one: it appeared to be an extension from the duodenum’ (Chalmers Watson).² The writer points out that the lesion would be in its results analogous to the effects of a ligature of the duct. It has been argued of the common biliary attack, in which glycogenic distension of the liver is an essential pathological condition, that blocking of the bile and pancreatic ducts is an important factor in the conservative inhibition of carbonization (§ 73).

Duckworth thus indicates the steps in a form of gout which is typical of a large class: ³—‘Hard-worked men living in towns,

¹ *Lectures on Senile Diseases*, Charcot, New Syd. Soc., p. 81.

² ‘Observations on the Pathogenesis of Gout,’ Chalmers Watson, *Brit. Med Journal*, January 9, 1904, p. 70.

³ *Treatise on Gout*, 1890, p. 270.

whose occupations are mainly sedentary, suffer in considerable proportion. . . . In such instances, there is often found to be a large appetite for food; . . . but a limit is placed to sufficient oxydation, by reason of the necessary urban and confined life, and the consequent defective aëration. If no relief be afforded, a measure of dyspepsia ensues, usually of catarrhal form, and pains and fulness are complained of in the liver. A sort of cumulative plethora is thus from time to time set up, and it is at such crises that a sudden precipitation of gouty inflammation may be looked for.¹ The above is almost a hyperpyraemic view, differing therefrom merely in the relative positions of the hepatic dyspepsia and the accumulation in the blood.

§ 596. DIETETIC TREATMENT.—In gout, as in the paroxysmal neuroses, two seemingly opposed methods of dietetic treatment have been advised—the treatment by reduction of carbonaceous food-stuffs, and the treatment by reduction of proteid. Both methods have given good results, and the explanation of this apparent inconsistency is, *up to a certain point*, the same as in the case of the paroxysmal neuroses.

The dietetic plan, which largely reduces the purely carbonaceous food-stuffs and throws the onus of nutrition mainly upon meat and other proteids, was long since advocated by Cantani,¹ and many other authorities still advocate this practice. The Salisbury diet (lean beef, white of egg, and hot water) may be regarded as the most exclusive specification of this general plan. In these methods, as already pointed out (§ 247), hyperpyraemia is dispersed mainly through a reduction of the carbonaceous *supply*.

Ebstein finds that the removal of obesity from gouty patients, by restriction of carbohydrates, has a beneficial influence upon the articular disorder: hence he infers that 'the fatty deposit affords a favourable soil for the disease.'² Some such inference seems inevitable, so long as we fail to realize that both gout and obesity depend upon a relatively excessive carbonaceous income and imply exaggerated acarbonization. But, having recognized the common factor and the common influence of the pathological and the physiological process, we must conclude, in the cases where gout and obesity are associated, (1) that the former is present in spite, and not in

¹ *Food in Health and Disease*, B. Yeo, 1897, p. 426.

² *Treatise on Gout*, Duckworth, 1890, p. 368.

consequence, of the latter; and (2) that a plan of diet, involving a large reduction in the carbonaceous intake, succeeds through removing the common factor of both conditions. In my experience, gout associated with obesity is comparatively easy to manage; and, as in the nearly parallel cases of migraine, asthma, glycosuria, etc., frequently disappears (though less rapidly) under a moderate restriction of the carbonaceous intake. From this I infer, amongst other things, that a well-developed fat-forming capacity (anabolic decarbonization) is of the greatest assistance in the treatment of this, as of every other, hyperpyraemic affection.

The dietetic plan which largely precludes meat and other nitrogenous food-stuffs is perhaps the one most generally practised. As already pointed out (§ 246), this plan, when successful, disperses hyperpyraemia through a partial abrogation of *function*, the carbonizing function of the digestive organs. But in the case of gout it has an additional important influence. Gout depends not only on hyperpyraemia, but, as I shall argue presently, also on uricaemia secondary thereto: hence the introduction of uric acid-forming material will be an important factor in the disease; and, by largely reducing the animal constituents of an *ordinary mixed diet*, the introduction of such uric acid-forming material is largely avoided. This question will be returned to again (§ 606).

THE RÔLE OF URIC ACID IN ACUTE GOUT

§ 597. Garrod has demonstrated experimentally—and his demonstration has never been seriously discredited—that 'in true¹ gout, uric acid, in the form of urate of soda, is invariably present in the blood in abnormal quantities, both prior to, and at the period of, the seizure': that² at this time, the elimination of uric acid, as measured by the twenty-four hours excretion, is diminished: 'that³ the acid is thrown out in much larger quantities as the disease is passing off, and that then, amounts even above the patient's daily average may be excreted, forming the so-called critical discharges; and that, after a time, the uric acid is again lessened, although not to the extent observed prior to, or at the commencement of, an attack.' Duckworth⁴ quotes Lecorche's researches on the

¹ *Gout and Rheumatic Gout*, 1876, pp. 274, 275.

² *Ib.*

² *Ib.* p. 133.

⁴ *Treatise on Gout*, 1890, p. 121.

elimination of uric acid in gout as the most exact, and says: ‘He has shown that the output is diminished before an acute attack, and is low for several days—two to four—during the paroxysm, increasing much above the normal the third and the following two days, and again falling to the normal towards the close of the attack. Hence, according to Lecorché, the greatest elimination occurs at the height of the paroxysm, and not at the end of it as found by Garrod.’ Futcher¹ has recently repeated these investigations. ‘The uric acid excreted by the kidneys was determined by the Hopkins method or the Folin modification. Almost invariably before the onset of acute symptoms, the uric acid was found below and often far below 0·4 gm., the lower limit of the daily uric acid excretion in health. On the second or third day after the beginning of the acute symptoms, the uric acid curve steadily rose, reaching 0·8 to 1 gm., the upper normal limit for the daily excretion, or even higher than this. With the subsidence of the acute symptoms, the curve gradually falls below the lower limit of the normal.’

Thus Lecorché and Futcher place the releasement of the uricaemia at an earlier stage of the acute gouty paroxysm than does Garrod. The difference between the two series of observations is of degree only and depends probably upon differences in the intensity of the gouty pyrexia. At any rate, they are immaterial here: all I am concerned to show is that uric acid is being retained in the blood prior to, and at the onset of, the attack, excreted in excess later.

§ 598. It has been argued that in gout hyperpyraemia is an essential factor, and that the paroxysm is an acarbonizing process. How then, bearing in mind the facts demonstrated by Garrod, can we avoid assuming that the hyperpyraemia is in some way responsible for the uric acid retention, and that the acarbonization permits of the free elimination of the acid? To my mind, the assumption is almost irresistible; and we need not hesitate because we are unable at present to form any conception as to the *mechanism* of the retention and release-
ment. Garrod sought to explain the retention of uric acid in the blood in gout by assuming a temporary failure of excretory power on the part of the kidney. But this view seems improbable, for, as T. B. Futcher² urges, ‘why should the

¹ *Progressive Medicine*, June 1903, vol. ii. p. 327.

² ‘Some Points on Metabolism in Gout,’ T. B. Futcher, *Practitioner*, August 1903, p. 184.

kidneys be capable of excreting more uric acid during the acute exacerbations, when their functional activity would be expected to be lowered, owing to the coexistent fever?' We are now called upon to assume that the overloaded condition of the blood is of such a nature that the kidney is unable to exert its selective function upon it, in so far, that is to say, as concerns the uric acid—in other words, to transfer the primary responsibility for the excretory failure from the kidneys to the blood.

This is hardly a novel conception. Parkes doubted the inadequacy of the kidney to excrete uric acid, and 'surmised that there was some peculiar and unnatural combination in the blood or organs which held back this and some other substances, notably phosphoric acid. "If this be the case, the deficient elimination is, as it were, only a consequence of more important antecedent aberrations in metamorphosis, of which impeded excretion is a natural sequence"' (Duckworth).¹ Ewart is manifestly hovering around a similar conclusion. After pointing out that the renal organs are apparently healthy, he says :²—'We are tempted to . . . ask whether the uric acid may not be rather held back in the blood than refused a passage through the kidney.' And this view is further to some extent supported by the fact, insisted upon by Haig, that a kidney in a late stage of degeneration may be capable of excreting uric acid in large quantities.

Normal secretion or excretion depends upon at least two conditions, namely (1) a proper quality of the supplied material, the blood ; and (2) a proper functional capacity on the part of the organ concerned. In the event of an unexplained failure arising, it is as reasonable to blame the one as the other, the supply as the function. Our assumption, then, is not more audacious than that of Garrod, while it has one clear advantage: it carries us a distinct step in advance and explains, as no other hypothesis has explained, why and how the temporary excretory disability comes to a natural termination.

§ 599. If it is admitted that hyperpyraemia is capable of causing retention of uric acid in the blood—and in the succeeding chapter I shall adduce a large amount of independent evidence in proof of this supposition,—then the remaining steps in the acute gouty paroxysm and the meaning of the whole

¹ *Treatise on Gout*, Duckworth, 1890, p. 9.

² *Gout and Goutiness*, Ewart, 1896, p. 148.

process present little difficulty. In default of dispersion of the hyperpyraemia, whether by physiological or pathological means, deficient renal elimination of uric acid would continue, perhaps become accentuated. In either case, the uric acid accumulation in the blood would progressively increase, until some special means of relief became urgently demanded. Such special means of relief might be provided by extra-vascular deposition of a portion of the load. Should this deposition take place in some tissue endowed with but a low degree of irritability, such for example as the cartilaginous tissues of the external ear, there will follow but little result: there will be formed probably a small uric acid nodule with only slight local irritation and no pyrexia. But, should the deposition occur in some tissue, such as the articular surface of a joint, which is capable of responding by acute inflammation to the irritation of the acid, pyrexia, associated with increased katabolic expenditure of carbon and, perhaps, some diminution of income through febrile anorexia, dyspepsia, etc., will ensue. The result will be a carbonization of the blood, and this will permit of free elimination of the retained uric acid by the kidneys. In this way, the uricaemia will be dispersed or, at any rate, reduced: the solvent power of the blood for uric acid will be regained: the extra-vascular deposits of uric acid absorbed: the arthritis will subside; and the paroxysm terminate.

§ 600. That the gouty pyrexia depends upon—is secondary to—the local articular inflammation, is shown by the fact that the intensity of the febrile reaction, contrary to what occurs in acute rheumatism, is proportionate to the number of joints affected¹ (Charcot). That the pyrexia so induced is the salutary factor of the acute gouty paroxysm, is shown by the fact that many substitutive pyrexial conditions are frequently equally salutary (§ 593); and by the phenomena of acute asthenic, and chronic, gout, to be considered later. In these modifications of acute gout, pyrexial reaction is present in descending degrees; while articular disorganization, deformity, and the manifestations of unrelieved hyperpyraemia, occur in ascending degrees (see Chapter XXIII).

On the view here adopted, the steps in the acute gouty paroxysm may be epitomized as under:—

1. Hyperpyraemia.
2. Uricaemia from failure of renal excretion.

¹ *Lectures on Senile Diseases*, Charcot, New Syd. Soc., p. 72.

3. Uratosis : deposition of uric acid in joint.
4. Local inflammation : arthritis.
5. Pyrexia.
6. Acarbonization of the blood.
7. Elimination of uric acid by the kidney.
8. Absorption of extra-vascular deposit of uric acid.

Thus the uricaemia works out its own dispersion, as well as the dispersion of the hyperpyraemia.

§ 601. The theory of gout just formulated, while demonstrating the primary and secondary humoral factors of the affection and the meaning of the whole process, does not clearly identify the proximate factor of the extra-vascular deposition of uric acid ; nor does it explain the special fondness of the uratic deposition for the first metatarso-phalangeal joint. It has been assumed that the deposition depends proximately upon a sort of overflow, the result of the progressively increasing accumulation of uric acid in the blood. This view is by no means inconsistent with Roberts's quadriurate theory, with which, indeed, it may be held in conjunction.

Roberts¹ demonstrated that 'sodium quadriurate is the soluble uric acid compound which is originally contained in the blood of gouty subjects' : this salt gradually undergoes conversion into the much more insoluble biurate, the form in which uric acid is deposited extra-vascularly (Luff). But for this conversion a certain time is required ; and this, in the case of gout, is assured by the element of retention which has been ascribed to hyperpyraemia. Hence in all probability it occurs, that diseases such as leukaemia, in which uric acid, though present in excess in the blood, is freely eliminated by the kidneys, do not tend to be complicated by extra-vascular uratic deposition. It would seem, then, when the uricaemia has persisted for a certain time and attained a certain high grade, that a portion of the quadriurate is converted into biurate, and that the latter is deposited extra-vascularly.

§ 602. The above seems to me by far the most tenable view. Under it the intense vaso-dilation, localized in the neighbourhood of the affected joint, is secondary to the deposition of the acid on the sensitive articular structures. But it has, I think, been suggested that the vaso-dilation is primary and the deposition of the acid secondary. This view has

¹ *Gout: its Pathology and Treatment*, A. P. Luff, 1898, p. 2.

perhaps one advantage, in that it brings the mechanism of the acute gouty paroxysm more accurately into line with the neurosal acarbonizing processes, with which gout is so intimately connected. Ewart¹ points out that 'during the attack itself . . . the vascular reactions acquire an almost stormy development': the initial rigor is evidence of widespread vasoconstriction of the surface, 'while² the pressure from the local vaso-dilation is probably the cause of much of the pain.'

§ 603. But these questions, though of high scientific interest, are immaterial from our present standpoint; and so also is the question as to the special proclivity of the great toe to the gouty attack, since none of the views which have been advanced conflict with the theory we are adopting. All I am here concerned to establish is that acute gout depends upon hyperpyraemia and is a conservative acarbonizing process, operating through pyrexia, the proximate factor of which pyrexia is extra-vascular deposition of uric acid. It follows from this definition of acute gout, that such terms as 'suppressed,' 'irregular,' 'abarticulär,' and 'larvaceous' gout, are misnomers. The condition of depraved general health which antecedes, leads up to, and is dispersed by, frank articular gout, is simply one of hyperpyraemia: it has no more right to the term 'gout' than the condition of depraved health which antecedes, leads up to, and is dispersed by, any other pathological acarbonizing process which depends upon hyperpyraemia. But it may be, as already suggested, that the hyperpyraemia which is terminated by acute articular gout is more intense and more complex, because more prolonged, and is associated with a higher degree of uricaemia, for the same or other reasons, than the hyperpyraemia which is terminated by the more frequently recurring neurosal acarbonizing processes.

VISCERAL GOUT

§ 604. The view that acute gouty arthritis is simply one conservative termination of hyperpyraemia,—that termination in which the uricaemia, a condition common in some degree to all hyperpyraemia (see Chapter XV), becomes the instrument of acarbonization—enables us to examine from a fresh standpoint the phenomena commonly ascribed to gout of the viscera.

¹ *Gout and Goutiness*, Ewart, 1896, p. 271.

² *Ib.* p. 272.

These visceral paroxysms may imitate very closely, if they are not identical with, many of the paroxysmal neuroses already considered. Gout of the stomach, in some cases, seems indistinguishable from gastralgic paroxysms generally; its symptoms, according to Luff,¹ are ‘severe pain in the stomach, accompanied usually by vomiting and a feeling of general oppression, depression, and faintness.’ Gout of the heart shows itself clinically as an angina pectoris: there is ‘pain² in the region of the heart, a sensation of constriction of the chest, dyspnoea, a small feeble pulse, and great anxiety’: there may be palpitation and syncope. The symptoms of gout of the brain are commonly set down as apoplectiform: they include ‘headache,³ stupor, convulsions, delirium, and occasionally . . . maniacal attacks. Transient attacks of aphasia, amnesia, and hemiplegia sometimes occur.’ But headaches indistinguishable from migraine are not infrequent; and most of the mental symptoms just enumerated have been observed, at different times, to complicate typical migraine,⁴ that is, migraine unassociated with articular gout. Numerous other varieties of visceral gout have been described: these are indeed as numerous as, because probably they are for the most part identical with, the manifestations of hyperpyraemia.

Ewart⁵ says that such cases may be arranged in two groups: (1) those ‘in which the visceral trouble appears first, and by its suddenness, severity, and unexplained and intangible causation, is, for a few hours, a diagnostic puzzle, after which the wonder subsides into common articular gout’; and (2) ‘those in which the visceral complication supervenes on the abrupt cessation of the articular lesion’: to the latter the term *retrocedent gout* is applied. In either case, the mechanism of the visceral phenomena may, as Ewart opines, be regarded as vaso-motor; for, seeing that gastralgia, angina pectoris, and migraine—all acarbonizing processes, or attempts at acarbonization, depending on hyperpyraemia and capable of replacing the acute gouty paroxysm—are vaso-motor in mechanism, it is reasonable to believe that the so-called visceral manifestations of gout, which so closely resemble these paroxysmal neuroses, and which are so intimately associated with the acute arthritic outbreak, are similarly caused, similarly adapted, and of similar

¹ *Gout: its Pathology and Treatment*, 1898, p. 125.

² *Ib.* p. 125.

³ *Ib.*

⁴ *Megrin and Sick-headache*, Liveing, 1873, chap. iii. and elsewhere.

⁵ *Gout and Goutiness*, 1896, p. 267.

mechanism. The visceral manifestation, which leads up to the acute arthritic paroxysm, we may regard as a commencing vaso-motor acarbonizing process, cut short and superseded by the more potent pyrexial acarbonizing process: elsewhere we shall see the more familiar vaso-motor acarbonizing process, migraine, similarly aborted and replaced by the pyrexia of an ordinary catarrh (§ 657). The visceral manifestation, which supervenes on the retrocession of the arthritic paroxysm, we may regard as a substitutive vaso-motor acarbonizing process, demanded and rendered possible by the intervention of factors, such as the application of cold to the affected joint, which have succeeded in checking prematurely—that is, before hyperpyraemia has been dispersed—the acarbonizing articular inflammation. We have seen that the localized vaso-dilation, which is associated with facial neuralgia, and which we have no reason to think is connected with the extra-vascular deposition of uric acid, may be similarly suppressed by cold applications and presumably transferred to some gastric area (§ 499).

§ 605. This vaso-motor conception of visceral gout does not necessitate abandonment of the view advanced by Roberts, that uric acid deposition occurs in these cases. It is probable that the uricaemia which precedes arthritic gout is more intense than the uricaemia which, I shall argue, precedes all pathological acarbonizing processes which depend upon hyperpyraemia; and we have entertained the idea that the uric acid deposition which occurs in arthritic gout is determined by a localized vaso-dilation (§ 602). It may be then that the visceral vaso-dilation which, it is assumed, constitutes attacks of visceral gout, is similarly associated, and that, in some cases, ‘showers of uric acid’ modify, or intensify, these visceral manifestations.

This view would possibly serve to explain some of those severe cases of retrocedent gout which end fatally, and in which overt inflammation can be demonstrated post mortem. Garrod quotes a case of Home’s, in which the suppression of slight articular gout was immediately followed by enteritis which proved fatal in twelve hours. He refers also to a similar occurrence in a patient of his own. ‘When¹ recovering from a moderately acute attack in the extremities, he was exposed to cold; he felt chilled, and within a few hours complained of pain in the abdomen; this increased and was accompanied with

¹ *Gout and Rheumatic Gout*, 1876, p. 439.

great constipation ; after a time the pain became very intense, the abdomen tympanitic, vomiting ensued, the pulse gradually got quicker and weaker, and the patient sank. A post-mortem examination revealed the nature of the case. The last eighteen inches of the ileum were found intensely inflamed, but the rest of the abdominal organs healthy.'

But, whether uric acid deposition enters into these cases or not, the records of the few necropsies which bear upon the mechanism of retrocedent gout seem to show that intense vaso-dilation is an essential factor in the process. Charcot¹ points out that Dietrich, Perry, and Budd made post-mortem examinations in fatal cases of gastric gouty metastasis. 'The patients have succumbed with the classical symptoms of gout which has retreated to the stomach, and there has been found an oedematous swelling of the submucous connective tissue of this organ, as well as more or less profound alterations of the mucous membrane itself.'

FACTORS IN GOUT, OTHER THAN HYPERPYRAEMIA AND RETENTION OF URIC ACID

§ 606. A little consideration will make it clear that, in the pathology of gout, there remain many factors, other than the humoral condition hyperpyraemia and the retention of uric acid secondary thereto.

FACTORS IN URICAEMIA, OTHER THAN HYPERPYRAEMIA.—Garrod maintains that the uricaemia which precedes, and is responsible for, the gouty paroxysm, is in the main due to retention, but he admits that uric acid may be *produced* in excess. Recent researches seem to show that, although the production of uric acid within the organism may vary, a much more important factor in the supply of uric acid to the blood is the introduction with the food of uric acid-forming material. Now, whether such increased supply of uric acid-forming material is to result in pathological uricaemia, or merely in increased uric acid excretion, will depend upon the existence or otherwise of imperfect renal elimination, and this upon the condition of the blood as regards its carbon contents—upon the degree of pyraemia, that is to say. Now the gouty are, on the view we are adopting, frequently more or less hyperpyraemic;

¹ *Lectures on Senile Diseases*, Charcot, New Syd. Soc.

and Von Noorden points out¹ that the rise of uric acid excretion after the ingestion of purin, or uric acid-forming, substances appears in gouty patients to be much more delayed than in the healthy. Such delayed excretion is clearly explicable by hyperpyraemic retention.

The researches of Burian, Schur, Horbaczewski, and Minskowsky² have shown that the uric acid-forming material consists, not, as was formerly thought, of proteid, which given in excess results merely in an increased excretion of urea, but of the nucleins, purins, and alloxur group, bodies contained in varying quantities in some, but not in all, of the animal nitrogenous food-stuffs: such food-stuffs are mainly roe, sweetbread, meat, and the extractives generally. It has also been shown that rather more than half the uric acid excretion of an individual upon an ordinary mixed diet represents the introduction with the food of these uric acid-forming materials: this moiety constitutes the *exogenous* uric acid of Chittenden.

It follows from the above, that, under an ordinary mixed diet, the amount of uric acid which passes through the blood on its way to excretion by the kidneys, will be roughly proportionate to the amount of animal food contained in the diet, though such relation is more or less incidental and does not depend upon the amount of proteid. If, then, in heavy meat-eaters hyperpyraemia occurs, the resulting uricaemia will in all probability be more intense, other things being equal, than in small meat-eaters or vegetarians; and uric acid will be more likely to become the acarbonizing agent. We might, perhaps, imagine that, through the greater introduction of uric acid-forming material, the accumulation of uric acid in the blood attains its climax earlier than the carbonaceous accumulation.

The importance of the introduction of uric acid-forming material in articular gout seemed clearly demonstrated in one of my cases:—

A stout gouty man wished to have his weight reduced. He was put upon a mainly lean meat diet while actually suffering from subacute gouty arthritis. A few days later the articular inflammation became acute, and other joints became affected (Case LIX).

Moderation in the use of meat and animal foods generally would explain in part the relative immunity from articular

¹ *Brit. Med. Journal*, September 24, 1904, p. 740.

² Woods-Hutchinson, *Lancet*, January 31, 1903, p. 288 *et seq.*

gout of women,¹ of residents in the tropics, and of the natives of France, Germany, Scotland, and other countries, even in the presence of lead-poisoning. On the same grounds we could explain the inverse correlation of gout and gall-stones (§ 96), as illustrated in the much greater frequency of the latter in women and in gout-free countries, and in the supervention of the latter in persons who have got rid of articular gout by vegetarianism; for we have seen reason to believe that a deficiency of proteid in the diet is an important factor in gall-stones (§ 96).

§ 607. NEGATIVE FACTORS IN GOUT.—But these questions may be viewed from a different standpoint. It may be that the uricaemia attains its climax and becomes the instrument of acarbonization, not so much through greater introduction of uric acid-forming material, as because the organism lacks the capacity to respond to hyperpyraemia by recurrent acarbonizing processes other than gout,—because, for example, of an inability to institute recurrent neurosal acarbonization of any sort. And, if we include in the history of gout an absence or inadequacy of neurosal acarbonization, we shall have to include also an absence or inadequacy of pathological acarbonization of every kind, that which is purely incidental, not less than that which depends upon hyperpyraemia. Consequently, in the complete pathology of gout we must include an extremely long series of negative factors.

This view would explain the comparative infrequency with which the gouty acarbonizing process tends to recur. A prolonged hyperpyraemia, not necessarily progressively increasing but merely uninterrupted, would, through introducing a slight but continuous inadequacy of renal excretion, be sufficient to cause a slow but steady accumulation of uric acid in the blood: ultimately, the accumulation would pass the point of tolerance and the gouty paroxysm occur. The immediate or determining antecedent of the paroxysm—the last straw, so to speak,—might consist either of a sudden increase of uricaemia consecutive to a sudden increase of hyperpyraemia from any cause, or of a sudden increase of uricaemia consecutive to a sudden increase of the intake of uric acid-forming material. The first factor would be illustrated in the onset of the paroxysm during the small hours of the morning: the second, in the induction of a

¹ *Gout and Rheumatic Gout*, Garrod, 1876, p. 240.

paroxysm by the increased ingestion of food rich in uric acid-forming material.

Hence it will be found that the clinical manifestations of hyperpyraemia or unrelieved hyperpyraemia (various headaches, neuralgias, dyspepsias, hepatic troubles, etc.), which so often precede the acute gouty attack, are more prolonged and persistent than those which sometimes precede the attacks of the paroxysmal neuroses: as B. London¹ points out, ‘affections of the peripheral nerves, particularly the various forms of neuralgia, frequently manifest themselves long before the appearance of the first typical attack of gout.’ In one of my cases, occipital neuralgia preceded by some weeks on two occasions an acute gouty paroxysm and disappeared thereafter.

§ 608. On the same view, we could explain more fully the relative immunity from articular gout of women during menstrual life,—an immunity which begins only after puberty, is in abeyance whenever menstruation is checked, and disappears at the menopause. It cannot be maintained that women are less liable than men to hyperpyraemia: indeed, we have seen reason to believe that a tendency to hyperpyraemia occurs *normally* in women towards the end of every intermenstrual period. But menstruation is itself a periodic acarbonizing process. Hence it could without difficulty be maintained that women, during menstrual life, are less liable than men to periods of *prolonged hyperpyraemia*.

But the menstrual process is only one of the recurrent acarbonizing processes, although it stands alone in the fact that it is physiological or semiphysiological in nature. Therefore it is clear that we must take into consideration the incidence of pathological acarbonization of all kinds before we can hope to elucidate completely such questions as the comparative immunity from articular gout of women during menstrual life, and of the residents of tropical and subtropical countries. If as is here argued, it is a result of more or less prolonged hyperpyraemia, gout will be vastly retarded in its development, if not completely obviated, by any pathological acarbonizing process which is efficient and frequently recurrent. For example, it would be unlikely for gout to develop in one who suffers from periodic bilious attacks, from periodic migraine

¹ ‘Treatment of Gout at Carlsbad,’ B. London, *Practitioner*, August 1903, p. 178.

associated with anorexia, or even from frequently recurrent headaches associated with distinct loss of appetite ; and the same would be true of one who suffers habitually or frequently from malarial or other endemic pyrexias. Hence, in all probability, a great part of the immunity of women from articular gout is due to their relatively greater proclivity to sick-headaches and to neurosal acarbonizing processes generally ; and much of the immunity of residents in the tropics is due to their relatively greater proclivity to disorders such as malaria, hepatic affections, and diabetes.

§ 609. It is often stated that the special proclivity of women to migraine has been much exaggerated—that women are only slightly more prone to this affection than men ; but this applies only to formal or typical migraine. The conservative feature of migraine consists principally of the anorexia : hence, amongst the negative factors of gout we must include an absence or inadequacy of all the numerous slighter varieties of sick and morning headaches—all those, at any rate, which are associated with loss of appetite or dyspeptic symptoms. And these, it will hardly be disputed, are largely ‘female complaints.’ This seems especially true of the tropics : as far as concerns North Queensland, at least, the women who do not suffer from some form of sick-headache would seem to be in an actual minority.

The preponderating frequency in women of these symptomatically trivial acarbonizing processes is not forced upon the notice of the profession, for few of those affected seek medical advice thereon. Yet the fact becomes conspicuous enough when systematic enquiries are made amongst the otherwise healthy female population. I have passed some fifteen years as a resident medical officer in hospitals, and have in consequence a rather extensive experience of hospital nurses. Hospital nurses, as a class, are certainly above the average in health and stamina ; and they are decidedly less prone than the average to hysterical manifestations. Yet recurrent sick-headaches, involving the omission of a meal or two, but not necessitating absence from duty, are present in a very large proportion. Miss Pampling, of the Brisbane General Hospital, kindly collected the following data for me :—

The number of nurses in that institution was forty-two, their ages varying between 20 and 33. Of the forty-two, twenty-one

suffered from some form of recurrent headache, none of which were sufficiently severe to necessitate absence from duty. Of the twenty-one, six had no loss of appetite during the headache : the remaining fifteen all had loss of appetite and missed from one to three meals at each attack.

It is impossible to ignore the aggregate conservative influence of such periodic attacks in diminishing the proclivity to severer forms of hyperpyraemic disease. Conformably, Harry Campbell remarks :¹—‘ I have been struck by the fact that many men suffering from articular gout have never displayed peculiar liability to headache of any kind.’

Dyspepsia is another everyday affection which is, I imagine, especially common in women and in persons of European birth who reside in the tropics. And dyspepsia, whether primary or secondary—whether independent of, or dependent upon, glycogenic distension of the liver—would tend to limit absorption, and thus to prevent, or disperse, hyperpyraemia, and to anticipate affections, such as gout, arising therefrom.

§ 610. Besides sick-headaches of all kinds, women are more prone than men to epilepsy, to the less serious forms of angina pectoris, to gastralgia, and to many affections of similar mechanism : in short, they seem more prone to pathological vaso-motor action generally. The female nervous system has always been regarded as less stable, or more irritable, than the male ; and the vaso-motor nervous system may well be supposed to share in such exalted irritability. We may imagine that the female vaso-motor system, being more delicately poised, so to speak, is apt to take earlier notice of the slighter departures from normal pyraemia, thus shielding the organism against the later and graver manifestations of hyperpyraemia. In like manner, we may ascribe to the gouty male a certain stability, inertia, or lack of irritability on the part of the vaso-motor system, a quality hostile to frequent neurosal acarbonization. Such a constitution of the vaso-motor nervous system might, in part, explain the undoubted hereditary factor in gout.

England is regarded as the modern home of gout. But, of late years, there has been a remarkable and indubitable subsidence in the number of cases of frank articular gout, with concurrently a rise in the number of cases of irregular or abarticular gout, terms which, I shall argue, cover the vaso-

¹ *Headache*, 1894, p. 204.

motor acarbonizing processes depending on hyperpyraemia. Now the conditions of life have admittedly undergone great alterations during the last half-century. Diet has altered: large joints, strong beer, and port wine have given way before small French dishes, bitter beer, and light wines. Thus, perchance, the intake of uric acid-forming material is less. Further, through the replacement of manual labour by machinery and the formation of complex industries, physical has largely given way to mental strain; and the railway, the telegraph, and the telephone, among other things, have greatly increased the pace at which we live. All these changed conditions seem to me just those which tend to increase nervous irritability and lessen resistance.¹ And, if so, such would conduce to greater frequency of the vaso-motor acarbonizing processes. Is there any general increase of these processes during recent years? There are, of course, no statistics to which we can appeal for information, and I can only give my own impression. That is, that all vaso-motor acarbonizing processes, more especially the numerous clinical varieties of biliary attacks, sick-headaches, secondary anorexias and dyspepsias, have appreciably increased, at any rate in the male sex, even during the last twenty years. And if this is true, it will account very largely for the subsidence of frank articular gout.

§ 611. But this argument may be carried further back. If we include amongst the negative factors of acute gout an absence of vaso-motor acarbonizing processes (pathological), then we must include also an absence of those factors which conduce to exalted vaso-motor irritability, and amongst these, probably, an absence of eye-strain. For eye-strain, according to Gould, is one of the most frequent factors of migraine, biliary attacks, biliaryness generally, and dyspepsia (§ 545 *et seq.*), all of which conditions are, as here argued, effectual preventives of gout. Now Gould says:²—‘The morbid results of eye-strain depend entirely upon use of the eyes within reading or writing or hand distance. The more such use, the more baneful the consequences. Civilization has multiplied

¹ The opinion has been widely expressed that the character of the English nation has undergone a change during recent years. Certainly the celebrations on Mafeking day had more in them of Gallic impetuosity than of what we are accustomed to regard as British imperturbability.

² ‘The Rôle of Eye-strain in Civilization,’ Geo. M. Gould, *Brit. Med. Journal*, September 26, 1903, p. 759.

a hundred or a thousand times the amount of such near-range work, *and the multiplication still goes rapidly on.* In making the eye, evolution never foresaw civilization, and that mechanism created for accuracy of distant vision is, of all organs, the one most glaringly ill adapted for the near vision our modern life relentlessly demands.' (Italics mine.)

Gout was regarded as an aristocratic disease; and I do not imagine that the average member of the class who mainly suffered—the leisured class of the eighteenth and early part of the nineteenth centuries—concerned himself greatly with pursuits requiring near vision: he could hardly be considered a literary or scientific enthusiast. But the rapidly increasing demands of education have, during the last century, vastly increased the probability of eye-strain, and until recently the means of prevention has been lacking. Consequently, it seems probable that increasing eye-strain should be included amongst the factors of decreasing acute articular gout.

§ 612. Everything goes to show that acute gout is, *par excellence*, the recurrent pathological acarbonizing process of those who are endowed with a stable, or inirritable, vaso-motor system, whatever be the factors of this condition—of those, in short, who are of an essentially masculine temperament and habit of body. And this view is, I think, confirmed by observation of the original physical and psychical characteristics of the great majority of sufferers.

We have entertained the view that the hyperpyraemia which antecedes the gouty acarbonizing paroxysm differs chemically from the hyperpyraemia which antecedes the more frequently recurring neurosal acarbonizing processes (§ 196), but this view would have no disturbing influence upon the arguments contained in this chapter.

SUMMARY

§ 613. In this chapter, I have attempted to show that acute gout depends upon hyperpyraemia and is a conservative acarbonizing process, operating through pyrexia, the proximate factor of which is extra-vascular deposition of uric acid in a tissue capable of responding by inflammatory reaction: that the extra-vascular deposition of uric acid depends upon a prior

uricaemia : that the uricaemia depends in the main upon deficient renal elimination, resulting from hyperpyraemia, but probably, in part also, upon the introduction in excess of uric acid-forming material : that the so-called visceral gout consists probably of vaso-motor manifestations of hyperpyraemia, possibly intensified in some cases by deposition of uric acid in the dilated area ; and that, in addition to the associated humoral conditions of hyperpyraemia and uricaemia, we must include in the pathology of gout many other factors, prominent amongst which are factors hostile to the occurrence of neurosal and other forms of pathological acarbonization.

CHAPTER XV

§§ 614–647

Retention and excretion of uric acid: daily fluctuations in carbon contents: menstrual fluctuations: physical exercise: paroxysmal neuroses: plumbism: pyrexia: glycosuria: disorders associated with retarded combustion: dietetic treatment: summary of evidence and conclusion—Other factors in excretion: uric acid excretion during starvation—Significance of uro-lithiasis: daily fluctuations in excretion of uric acid: menstrual fluctuations in excretion of uric acid: physical exercise and uric acid excretion: the paroxysmal neuroses and uric acid excretion: pyrexia and uric acid excretion: disorders associated with retarded combustion and uricaemia: glycosuria and uricaemia: dietetic treatment: epitome—Relations of uro-lithiasis to gout and to functional derangements of the liver—Uric acid as a factor in disease.

§ 614. It has been argued that, in acute gout, the initial uricaemia is, in part at least, due to retention: that the retention depends upon hyperpyraemia; and that the subsequent elimination of uric acid by the kidneys is permitted by a carbonization of the blood. These inferences may be generalized as follows. *Other things being equal, the carbon contents of the blood determine directly the accumulation of uric acid in the blood, inversely the excretion of uric acid by the kidneys.* And the law, so formulated, will be found to hold good over a wide portion of, if not throughout, the domains of both physiology and pathology.

§ 615. DAILY FLUCTUATIONS IN CARBON CONTENTS.—We have seen that, from about midnight to the early morning hours, the rate of combustion is low: that at the latter time a rise begins, which continues throughout the forenoon: that, through the afternoon, combustion is steady; and that, in the evening, a fall sets in. And it has been argued that, so long as there is a supply of carbonaceous material from the organs of digestion, the carbon contents of the blood will tend to vary inversely with the rate of combustion (§ 300). Hence, if the law above formulated is true, the excretion of uric acid will tend to vary directly with the rate of combustion.

I here reproduce Haig's chart of the uric acid excretion during the three periods (7 A.M. to 11 P.M. : 11 P.M. to 4 A.M. : 4 A.M. to 7 A.M.) of the twenty-four hours; and I ask the reader to compare it with the adjoining chart. The latter is constructed from the observations of Liebermeister in fig. 1, and represents the approximate average temperatures—and, inferentially, the approximate averages in the rate of combustion—during the same periods of the twenty-four hours.

The comparison between these two charts is given for what it is worth. It is not, of course, claimed that the fluctuations of uric acid excretion depend *solely* upon fluctuations of combustion. Undoubtedly, they depend in great part, if not mainly, upon variations of introduction of uric acid-forming material with the food (§§ 632 to 634); and they may possibly be influenced by variations in the production of uric acid (endogenous).

The retention of uric acid in the blood during the small hours completes the explanation of the marked proclivity to extra-vascular precipitation (arthritic gout) at this time.

§ 616. MENSTRUAL FLUCTUATIONS IN CARBON CONTENTS.—I have inferred high carbon contents, or a tendency to hyperpyraemia, just before and at the commencement of menstruation: a fall thereafter when the flow has become well established. And in summing up the results of several quantitative analyses of the output of uric acid prior to, during, and succeeding menstruation, Haig says:¹—‘Menstruation is generally accompanied by a plus excretion of uric acid, especially towards the end of, or after the period was over, and in cases

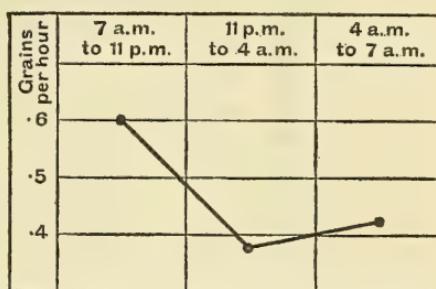


FIG. 5.—Chart showing the daily fluctuations of uric acid excretion. From Haig's ‘Uric Acid in Disease.’

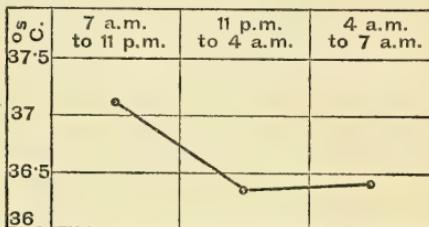


FIG. 6.—Chart showing corresponding daily fluctuations of temperature and inferentially in combustion. Constructed from Liebermeister's observations (see Fig. 1).

¹ *Uric Acid in Disease*, 1897, pp. 122, 123.

where I got the excretion a few days before the period began, it rather appeared as if its onset was accompanied by a diminished excretion of uric acid. . . . It thus appears probable that menstruation merely causes a fluctuation in the excretion of uric acid, a diminished excretion or retention just before or at the beginning of the period, followed by a corresponding plus excretion during the period and just after its termination.'

§ 617. PHYSICAL EXERCISE.—Physical exercise greatly increases combustion and thus tends to reduce the carbon contents of the blood. Conformably, Ewart says:¹—'Muscular exercise has a decided effect in increasing the output of uric acid'; and Levison² gives the results of 'active muscular exercise in the saddle.' He says:—'Two experiments were

made, eight days elapsing between them; and the excretion rose, by this means, from about 0·6 grm. to 0·981 or 0·985, and, in the second experiment, to 1·089 grm.' I reproduce Haig's diagram, showing the influence of three hours' bicycle riding on the excretion of uric acid, urea, and water.

That the increased excretion of uric acid following exercise is due to the dispersion of hyperpyraemia, which had caused the retention of this excretory product in the blood, and not to an increased production, is assured by an observation of R. Hutchinson.³ This author says:—'Levi-

FIG. 7.—Chart showing the influence of three hours' bicycle ride on the uric acid excretion. From Haig's 'Uric Acid in Disease.'

son's assertion that uric acid excretion is increased by exercise requires modification. When a man of sedentary habits takes exercise, the excretion of uric acid is increased for the first day or two, but, if the exercise be continued daily, the increase

¹ *Gout and Goutiness*, 1896, p. 99.

² *Uric Acid Diathesis*, 1894, p. 37.

³ *Med. Annual*, 1902, p. 301.

is not maintained.' Duckworth also points out that the exercise which increases the excretion of uric acid is 'unwonted exercise.'¹ The *temporary* increase in uric acid excretion which follows exercise may be compared with the *temporary* increase which accompanies the onset of any pyrexial condition (§ 626).

The dispersion of the uric acid accumulation by exercise fully demonstrates the means whereby impending attacks of gout have been occasionally dispersed by walking, running, riding, etc.

§ 618. THE PAROXYSMAL NEUROSES.—These affections, we have seen, may have their origin in a pathological degree of high carbon contents, or hyperpyraemia ; and constitute acarbonizing processes. Hence we are prepared to find that, at their onset, uric acid exists in increased quantity in the blood, associated with a diminished excretion in the urine ; and that during or towards the end of the paroxysm uric acid is excreted in excess.

In *migraine*, Haig² has shown that for several days before the attack the excretion of uric acid is low : that during the twenty-four hours in which the headache occurs the excretion is greatly increased ; and that this plus excretion compensates practically for the previous minus excretion. Haig, however, does not seem to admit the possibility of an excess of uric acid *in the blood*, except when associated with an excessive excretion by the urine : indeed, he seems to accept the latter as a measure of the former, and to deny inferentially the possibility of a *retention of uric acid in the blood*. Hence he assumes that just antecedent to the commencement of migraine uric acid is absent from the blood, being retained *extra-vascularly* in the tissues or organs of the body. It follows that he regards the headache of migraine as due to the passage of the uric acid from the tissues through the blood on its way towards excretion by the kidneys,—as an unfortunate, but inevitable, attendant on the process of elimination. On the view here adopted, the migraine attack is the instrument whereby the blood is freed from its pathological load, both carbonaceous and uratic.

Now Haig has offered no facts in support of this antecedent extra-vascular retention of uric acid ; nor does he state that he has examined the blood and found uric acid absent from that

¹ *Treatise on Gout*, Duckworth, 1890, p. 38.

² *Uric Acid in Disease*, 1897, p. 193.

fluid prior to the attack. It is true he points to the sense of well-being which, in some cases, immediately precedes migraine attacks, as evidence of the absence of uric acid.¹ But this could not be accepted, unless it were shown that uricaemia is capable of causing the opposite sensation; and we know that the marked uricaemia which Garrod has proved immediately precedes the gouty attack, is not infrequently associated with the same sensation of well-being.

§ 619. This sense of well-being, the ‘dangerously well’ feeling of George Eliot, is interesting but, so far as I am concerned, inexplicable. It is liable to occur as an immediate forewarning of many pathological acarbonizing processes which depend upon hyperpyraemia. Speaking of epilepsy in the insane, W. Bevan Lewis says :²—‘Joyous elation may precede an attack, a general state of optimism be present, often associated, however, with gross egoistical sentiments.’ I have known sensations of special elation immediately precede epileptic fits in the sane, ordinary bilious attacks, and attacks which can only be described as recurrent hepatic anorexia; and Salter³ says that ‘a peculiar and unwonted hilarity and animation and sense of health’ may occur as a forewarning of the asthmatic paroxysm. But such, after all, are exceptional. Usually, as already mentioned, the sensations premonitory of the pathological acarbonizing processes which depend upon hyperpyraemia are the reverse of pleasant (§ 338).

§ 620. We may believe, then, in the absence of a demonstration to the contrary, that, in migraine as in gout, the attack is preceded by uricaemia due to retention: that the uricaemia corresponds to the period of minus excretion by the kidneys; and that, during the paroxysm, the acid is being released and eliminated: in short, that *the uricaemia and plus excretion alternate, rather than concur*.

This point is of very great importance, and Garrod’s investigations are strongly confirmatory of the view here adopted. Garrod points out that, in all the cases which he examined, the presence of uricaemia or uric acid in the blood was associated with a *diminished excretion of uric acid in the urine*; and that ‘in many . . . diseases, as of the liver and spleen, although the production of uric acid may be greatly

¹ *Uric Acid in Disease*, 1897, p. 212.

² *Text-book of Mental Diseases*, W. Bevan Lewis, 1899, pp. 260, 261.

³ *On Asthma*, 1868, p. 29.

augmented, still the kidneys retain their eliminating power and the blood is thus kept free.'¹ He adds:—'The knowledge of these facts is of considerable importance, for it is frequently assumed that the appearance of a large quantity of uric acid in the urine indicates a contaminated state of the blood, whereas, on reflection, it will be evident that it favours the opposite view, for if the kidneys excrete freely, the blood has a much greater chance of remaining free.' Even in leukaemia, where the daily excretion of uric acid by the urine amounts sometimes to upwards of 20 grains, 'according to most authors, uric acid is not found in the blood, though some have asserted its presence' (Robert Muir).² Haig's frequent assumption that diminished excretion of uric acid in the urine precludes uricaemia, seems to me the weakest point in his generalization.

Now, if it is true that uricaemia and plus excretion of uric acid alternate rather than concur, then it follows that during the migraine headache there is actually less uric acid in the blood than just previously. Consequently, the uricaemia cannot be the cause of the headache.

§ 621. That the passage of uric acid through the blood, even in large quantities, does not give rise to migraine or any other kind of headache, can, I think, be readily demonstrated. In the Appendix to this work are detailed many cases in which recurrent migraine of long duration was dispersed indefinitely by the enforcement of a diet scale containing a considerable increase of meat and extractives. But in a few cases I have gone further than this. For a portion of the ordinary meat I have substituted fish roe, sweetbread, and liver, and at the same time given strong soup three times daily. Such articles of diet are, according to recent researches, amongst the richest in uric acid-forming material ; and their ingestion must have been succeeded by a large increase in the uric acid excretion and, therefore, in the amount of uric acid passing through the blood. It may be added that all these patients were taking tea and coffee in ordinary quantities, some of them largely. On Haig's theory, then, headaches should have recurred ; but they did not.

§ 622. In *Asthma*, Haig³ infers, but does not seem to have demonstrated by experiment, that the asthmatic paroxysm is accompanied by a plus excretion of uric acid. In this case, I am

¹ *Gout and Rheumatic Gout*, 1876, p. 132.

² Clifford Allbutt's *System of Medicine*, vol. v. p. 647.
Uric Acid in Disease, 1897, chap. ix.

in the same position, having no facts to show excessive excretion ; but I have little doubt that such occurs in asthma just as, we shall see presently, it occurs in epilepsy, and just as, we have already seen, it occurs after physiological exercise ; and uratic deposits are seen quite frequently after the asthmatic paroxysm.

I have, however, one experimental fact which shows that, during an asthmatic attack—before its termination, that is to say—the blood may contain uric acid in estimable quantities. In the case of the child (mentioned in § 400) who, during his first attack of asthma, fell and divided a branch of the superficial temporal artery, Dr. Thomas, Resident Medical Officer of the Sick Children's Hospital, Brisbane, submitted some of the blood, which escaped from the wound during its dressing, to Garrod's thread test. It was found to be rich in uric acid. In this case, it will be remembered that the asthma had but just commenced on two occasions when it was checked by haemorrhage ; and, consequently, we should not expect the hyperpyraemia, nor the consecutive uricaemia, to have been dispersed completely.

§ 623. Garrod says :¹—‘ During attacks of *epilepsy* . . . in persons not known to have had gout, I have examined the blood and found it to be rich in uric acid : the value of this fact cannot be estimated at present, but must be left to future observation and enquiry.’ In a case of major epilepsy Haig² found that ‘ in the seven hours preceding the fits the uric acid excretion was very small . . . in spite of the fact that these hours included the alkaline tide after breakfast, when the excretion of uric acid should normally have been large ; . . . the uric acid excretion rose with each set of fits, and fell in the interval between them, and with the most severe, which occurred in the early morning hours of the following day, the uric acid rose very high . . . and when the fits finally ceased, it returned nearly to the normal.’ In another of Haig’s³ cases, examination of the urine after slight fits yielded negative results, but after a severe one showed a large excess in uric acid excretion. Manifestly, the amount of excretion would be proportionate, *inter alia*, to the degree of acarbonization, and this to the severity of the fit.

As in migraine, so in epilepsy, Haig regards the plus excre-

¹ *Gout and Rheumatic Gout*, 1876, p. 461.

² *Uric Acid in Disease*, 1897, pp. 211, 212.

³ *Ib.* pp. 213, 214.

tion of uric acid—or, rather, the uricaemia of which the plus excretion is, on his view, the index—as the cause of the paroxysm. Now an epileptic attack, equally with an asthmatic attack, may be regarded as a pathological form of exercise; and Haig himself admits that physiological exercise is associated with a plus excretion of uric acid (§ 617). If, then, we entertain the view that the process of elimination of uric acid is the cause of the pathological forms of exercise, should we not have to extend this view to the physiological form of exercise—in the case in question, a bicycle ride?

§ 624. In one of my cases, an intensely severe attack of *recurrent gastralgia*, accompanied by prolonged and violent vomiting, was succeeded by an enormous deposit of urates in the urine passed just after the attack and on the following day (Case XLVII); and the patient informed me that similar deposits always occurred in these circumstances.

Hence we see how close is the affinity, and how complete the antagonism, between the acute gouty attack and a formal attack—an attack, that is to say, in which acarbonization is effectually attained—of any of the paroxysmal neuroses: we see clearly why they replace each other in the same individual, and why it is extremely rare for the two to concur, except in very modified forms.

§ 625. PLUMBISM.—The tendency of plumbism to cause hyperpyraemia has been argued (§ 232); and plumbism is apparently always associated with distinct uricaemia and with diminished excretion of uric acid in the urine. Garrod¹ examined the blood in twelve cases of lead poisoning. Of these, three suffered from gout and had uric acid in the blood; nine had no trace of gout, yet in all but two uric acid was found in the blood, mostly in considerable quantities. The influence of lead to diminish the excretion in the urine of uric acid was clearly shown in two cases by the administration of the drug as a medicine.² In the first case, lead acetate in 4-grain doses three times daily reduced the average daily excretion from 6.50 grains to 3.65 grains, and on a second occasion to 2.66 grains. In the second case, 2 grains of lead acetate thrice daily reduced the average daily excretion from 6.76 grains to 5.92 grains. Garrod says:³ ‘It would

¹ *Gout and Rheumatic Gout*, 1876, p. 240 *et seq.*

² *Ib.* p. 242 *et seq.*

³ *Ib.* p. 243.

appear therefore that, in individuals impregnated with lead, the blood becomes loaded with uric acid, not from its increased formation, but from its imperfect excretion.'

§ 626. PYREXIA.—We have seen that during the gouty pyrexia the elimination of uric acid by the kidneys is increased. The same can be shown to occur during other pyrexias. Bristowe,¹ after referring to the well-known increase in urea excretion characteristic of fever, adds:—'Uric acid also is increased and may be increased twofold.' Schultze² was conducting a series of experiments on his own uric acid excretion. 'During the course of the experiments, fever and malaise, accompanied by headache, appeared one day; the diet on this day was mixed, but not very abundant. In twenty-four hours, 37·08 grms. urea and 1·2687 grms. uric acid were excreted; consequently, while the excretion of urea was nearly normal, the excretion of uric acid was almost as much increased as by a large quantity of animal food' (Levison).

The pyrexial increase in uric acid excretion is not due to increased introduction of uric acid-forming material, since the intake of food of all kinds is as a rule markedly decreased in pyrexia; nor is it probable that the increase depends upon increased formation. We have seen that the increased excretion associated with the gouty pyrexia represents the dispersion of a prior uricaemia, due to retention; and, conformably, we have seen that the blood is clear of uric acid after the attack. The same can be shown to be true of pyrexia otherwise induced. Haig says:³—'There is one point . . . which I would specially like to bring to the notice of those who may make clinical observations on the effects of fevers on the excretion of uric acid, namely, that the blood and urine are *most completely cleared of uric acid during the first few days of the fever.*' (Italics mine.)

Haig ascribes the dispersion of uricaemia in the early stages of fever to diminishing alkalinity of the blood, whereby this fluid loses its power to retain uric acid in solution. He considers that, as a consequence of this, the uric acid is deposited extra-vascularly in the spleen and other tissues of the body. But it seems to me that this assumption is unnecessary, as well as unsupported, since the marked increase of uric acid

¹ *Theory and Practice of Medicine*, 1884, p. 108.

² *Uric Acid Diathesis*, Levison, 1894, p. 30.

³ *Uric Acid in Disease*, 1897, p. 491.

excretion by the kidneys during the early stages of fever is ample to account for the dispersion of any previously existing uricaemia.

§ 627. Were the pyrexial increase of uric acid excretion an index of increased uric acid production, there would be no apparent valid reason why it should cease with the initial stages of the pyrexia. Conformably with the view that the initial pyrexial increase of uric acid excretion represents the releasement of an antecedent accumulation from retention, Garrod could never find uric acid in the blood during rheumatic fever; and Levison quotes Von Jaksch to the effect that, 'in the examination of ten patients, who suffered from typhoid fever, no uric acid was found during the fever'¹ in the blood, but that 'in one case, in which the blood was taken while the patient had already commenced the non-febrile stage, a small quantity of uric acid was found.' 'Similarly,'² in intermittent fever, there was no uric acid during the fever, but, when the temperature fell, uricacidaemia supervened' (Haig). That uricaemia should arise during convalescence, still further confirms the view that it is due to retention depending upon hyperpyraemia; for I have argued that hyperpyraemia is peculiarly liable to arise as a result of the exaggerated nitrogenous disintegration of pyrexia, when once the exaggerated combustion has ceased (§§ 104 and 230). The fact that Von Jaksch found uric acid 'constantly'³ present, and in considerable quantity, in five cases of pneumonia, even during the febrile stage, would tend to show that retention of uric acid may be due to causes other than hyperpyraemia—possibly, in the case under consideration, to accumulation of carbonic acid in the blood.

It seems clear, then, that pyrexia generally and physical exercise are identical in their effects upon the excretion of uric acid: they increase it at the expense of a prior accumulation; and they do this by increasing combustion, and so dispersing any previously existing carbonaceous accumulation upon which the uricaemia depends. The amount of uric acid excreted in the early stages of fever, as after unaccustomed exercise, will depend largely upon the intensity of the previous uricaemia, and this, *inter alia*, upon the previous hyperpyraemia or

¹ *The Uric Acid Diathesis*, F. Levison, 1894, p. 42.

² *Uric Acid in Disease*, 1897, p. 78.

³ *Ib.* p. 79.

tendency thereto. Hence, probably, the marked excretion associated with the gouty pyrexia, which depends upon both these blood states.

§ 628. GLYCOSURIA.—This affection has been regarded as an acarbonizing process (§ 269); and Haig gives a remarkable chart (reproduced below) which shows that the output of sugar and uric acid may run parallel to each other with almost mathematical accuracy.

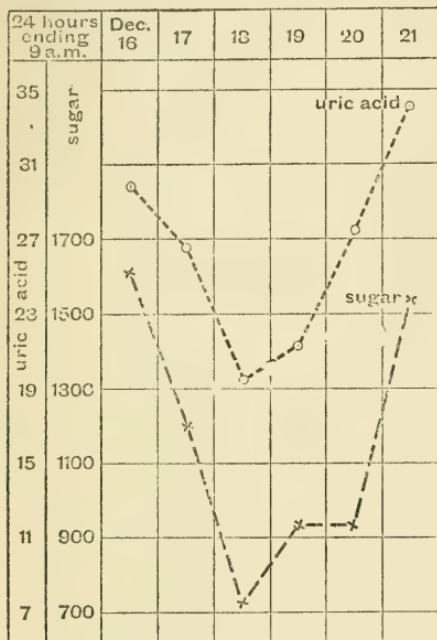


FIG. 7.—Chart showing the parallelism of the uric acid and sugar excretion. From Haig's 'Uric Acid in Disease.'

Such a relation would seem sufficient to complete the explanation already given (§ 590), as to the replacement of gout by diabetes, and of the converse occurrence.

§ 629. DISORDERS ASSOCIATED WITH RETARDED COMBUSTION.—In most disorders associated with retarded combustion, hyperpyrexia is liable to occur; and in many of these uric acid has been found in the blood in appreciable quantities. Von Jaksch¹ found uric acid in the blood of both primary and secondary anaemia; and in conditions

inducing dyspnoea, notably *heart disease*, *pleurisy with effusion*, *pulmonary catarrh*, and *emphysema*. In anaemia, he concluded 'that² the occurrence of uric acid in the blood was due to diminution of the oxidizing activity of the red corpuscles and to consequent storing up in the blood of uric acid formed in the body,' a view which, so far, is identical with ours. But Von Jaksch considered that 'most of the uric acid formed in the body becomes further oxidized in the blood by the activity of the red blood corpuscles' (Levison):³ hence he ascribed the retention of uric acid in the blood to the fact that these further

¹ *Gout: its Pathology and Treatment*, 1898, A. P. Luff, p. 48.
² *Ib.* p. 49.
³ *Uric Acid Diathesis*, Levison, 1894, p. 42.

changes are inhibited through the diminished functional activity of the red blood corpuscles. In my view, the diminished oxidizing activity leads to hyperpyraemia, which has the effect of holding back the uric acid in the blood.

In this connexion, the following is pertinent. James Tyson says :¹—‘A uric acid case should be treated as an anaemic case in all measures employed to promote the oxygenation powers of the blood, *i.e.* the production of an increase in the red blood corpuscles and of the haemoglobin and its chief oxygen carrier—iron. . . . Whatever medicinal and hygienic measures tend to a successful aeration of the blood should be employed. Accordingly, Dr. Crofton says, the most striking results have been obtained, in acute cases, by inhalations of oxygen gas. On six occasions, he claims to have aborted an attack of gout by inhalations of oxygen repeated at short intervals. He believes, too, that he can invariably relieve, if not cure, a uric acid headache, a migraine, in short, lithaemic attacks, by oxygen inhalations.’

The theory of hyperpyraemia is opposed to the view of Haig² that uricaemia is responsible for deficient combustion: it confirms, on the other hand, the view, accepted by the majority of authorities, that deficient combustion leads to uricaemia; and it carries us a step farther in explanation of this sequence of events.

§ 630. DIETETIC TREATMENT.—Important evidence of the truth of the views here adopted with regard to the retention and excretion of uric acid may be obtained by observing the effect of dietetic treatment which is directed to prevent or disperse hyperpyraemia; and here we shall be in accord with many eminent authorities. As already mentioned, Cantani long since advised the treatment of gout by the restriction of the carbohydrates rather than the nitrogenous food-stuffs; and gout, as already argued, depends upon uricaemia secondary to hyperpyraemia. Now W. H. Draper says:³—‘One of the best means of avoiding *accumulation of lithic acid in the blood* is to diminish the carbohydrates, rather than the azotized foods.’ (Italics mine.)

It is undecided to what extent we are justified in regarding

¹ *New York Med. Journal*, March 15, 1902, p. 457.

² *Uric Acid in Disease*, 1897, p. 128.

³ *Text-book of Medicine*, Osler, 1894, p. 293.

urolithiasis as an indication of excessive excretion of uric acid ; and, therefore, I have avoided reference to this condition in the present argument. But, if it is admitted that uro-lithiasis does, in some cases, indicate excretion in excess, then we shall have a further series of facts more or less confirmatory of the dependence of uricaemia upon hyperpyraemia and of excess excretion upon acarbonization of the blood : this applies especially to diet. The subject will be considered presently.

§ 631. SUMMARY OF EVIDENCE AND CONCLUSION.—We have seen, on the one hand, that whatever conditions conduce to high carbon contents of the blood or to hyperpyraemia conduce to uricaemia and to diminished excretion of uric acid in the urine. Amongst the conditions so operating are the rhythmic retardations of combustion in the diurnal cycle : the premenstrual period : physical inactivity : the period preceding the attacks of the paroxysmal neuroses and other pathological acarbonizing processes depending on hyperpyraemia, such as gout : plumbism : the post-pyrexial period ; and many affections associated with respiratory insufficiency.

We have seen, on the other hand, that whatever conditions conduce to acarbonization of the blood conduce to the dispersion of uricaemia and to increased excretion of uric acid in the urine. Amongst the conditions so operating are the diurnal increase of combustion associated with the rising activity of the waking and working day : the periodic haemorrhage of menstruation : the increase of combustion due to physiological exercise : that which is due to pathological forms of exercise, such as occur in epilepsy and asthma, and that which is due to pyrexia : the direct carbonaceous loss entailed by glycosuria ; and the restriction of carbonaceous income which occurs in some of the paroxysmal neuroses and in certain forms of dietetic treatment.

We seem, therefore, to be amply justified in the generalization we ventured to formulate, to the effect that, *other things being equal, the carbon contents of the blood determine directly the accumulation of uric acid in the blood, inversely, the excretion of uric acid by the kidneys.* Hence the assumptions we made in connexion with acute gout, that the hyperpyraemia is responsible for the uricaemia, and the pyrexial acarbonization of the articular paroxysm for the dispersion of the uricaemia through increased renal excretion of uric acid, cease to be

assumptions : they become instead mere individual examples of the working of a general law which holds good over a large portion of the domains of physiology and pathology. For what happens in acute gout is what happens in all cases when physiological high carbon contents of the blood, or pathological hyperpyraemia, are dispersed by acarbonization, physiological or pathological—free renal elimination of uric acid disperses uricaemia. In other words, the behaviour of uric acid, as regards retention and excretion, runs parallel with the behaviour of carbonaceous material in the same respects : it has no constant relation, on the other hand, to urea, the chief waste product of nitrogenous katabolism.

We are thus led to the belief that the introduction of uric acid forming material into the system is of minor importance under conditions which preclude the occurrence of hyperpyraemia ; for the uric acid, so conditioned, will be freely eliminated, and retention, which seems the most potent pathological factor, will not occur. In this way, but in no other, so far as I can see, can we explain the success in gout, some cases of urolithiasis, and other affections depending on uricaemia, of the dietetic plans of treatment advised by Cantani and Salisbury, both of which must of necessity increase materially the amount of uric acid which passes through the blood.

The views here expressed as to the retention and excretion of uric acid do not touch the problem of the seat of formation of this waste material within the organism. They will hold, whether this be the liver, the spleen, the tissues generally, or, as Garrod latterly supposed, and as Luff still ably maintains,¹ the kidney itself.

OTHER FACTORS IN EXCRETION OF URIC ACID

§ 632. It is not, of course, contended that all the variations in the excretion of uric acid depend upon variations in the carbon contents of the blood. It is clear that, in many cases, other things are by no means equal ; and it is to be anticipated that the excretion of uric acid will vary directly, to a large extent, with the formation of uric acid, with the introduction of uric acid-forming material, or with both. Roberts² ‘ made,

¹ *Gout: its Pathology and Treatment*, 1898, p. 36 et seq.

² *Text-book of Medicine*, Hilton Fagge, 1891, vol. ii. p. 420.

during seven days, a series of observations on a person who dined at 2 P.M. and afterwards took no solid food till the next morning. He found that during the period when the urine was alkaline after the meal, which was from about 4 P.M. till 7 P.M., the quantity of lithic acid excretion in each hour was three times greater than it was from 9 P.M. till 11 P.M., or later on during sleep.'

Now, although the low excretion, during the late evening and night, might be explained by falling combustion, high carbon contents of, and tendency to retention of uric acid in, the blood, yet the high excretion during the afternoon could not be explained satisfactorily by the opposite conditions. The high afternoon excretion is probably associated with an increase in the carbon contents of the blood: it cannot, therefore, depend upon the releasement of a prior uricaemia: it must depend upon increased production of uric acid, upon increased introduction of uric acid-forming material, or upon both.

Increased production is the basis of Horbaczewski's theory. This investigator inferred from experiments by Maress and himself, that the increased excretion of uric acid which follows a meal is due to 'digestive leucocytosis and the consequent increased liberation of nuclein within the organism.'¹ But Professor W. D. Halliburton is reported to have said² that 'too much stress appeared to him to be laid upon the part taken by the leucocytes. Were all the blood-leucocytes collected into one mass, the resulting organ would not be larger than a marble, and the total daily destruction of such a volume would not furnish the amount of uric acid excreted in normal urine.'

As already pointed out (§ 606), recent researches tend to the belief that the introduction of uric acid-forming material is the most important factor in the supply of uric acid to the blood; and, consequently, it is fair to infer that this is also the most important, if not the only, factor in the post-prandial increase of uric acid excretion. In support of this view, F. Gowland Hopkins says: ³—'Whatever the effect of globulins or albumins, there appears to be no doubt that ingestion of nucleo-proteid increases the excretion of uric acid; calves'

¹ W. D. Halliburton, *Brit. Med. Journal*, September 15, 1900, p. 735.

² *Brit. Med. Journal*, March 7, 1903, p. 549.

³ *Text-book of Physiology*, Schäfer, vol. i. pp. 594, 595.

thymus, with its abundant nuclein, has been largely used to test this point. Umber and Weinrand have found that with thymus the excretion of uric acid may amount to double that of the same individual upon ordinary proteid (muscle) diet of equal nitrogenous value.' Further, 'Camerer¹ has recently found that this rise of uric acid after a meal is by no means marked, unless the food contains nuclein. On a diet composed, for instance, of egg-albumin, the rise was very small, while, *during the digestion of non-nitrogenous diet, the output of uric acid was even diminished.*' (Italics mine.) 'Camerer holds, therefore, that digestive leucocytosis cannot be the cause of post-prandial increase, but only the actual ingestion of nucleins.'

§ 633. Nevertheless, I do not think we are as yet justified in denying that digestive leucocytosis results in some increase in the formation of uric acid. Though it is slight, there is still a perceptible increase of uric acid excretion following the ingestion of nuclein-free proteid; and this increase is, perhaps, most readily explained by an increased formation which may depend upon leucocytosis. But I cannot think that it would be correct to regard all the increased excretion of uric acid which follows the ingestion of nuclein-free proteid as due to increased formation dependent on leucocytosis. For there appear to be other ways in which the ingestion of pure proteid can increase uric acid excretion. Haig says :²—'In eggs . . . I have been unable to find any uric acid or other members of the xanthin group, such as I have found in meat, and yet their steady and graduated administration invariably brings about a large rise in the excretion of uric acid . . . so that I have had to exclude them entirely from my diet.' Eggs consist largely of proteid, and proteid increases the digestion and absorption of all food-stuffs (§§ 55 to 60) from which it is impossible to exclude all uric acid-forming material: thus a part of the increased excretion of uric acid which follows the addition of eggs to a diet might mean increased introduction into the blood of uric acid-forming material. But further, proteid increases the catabolism of tissue proteid and the consequent formation of urea; and there seems no reason at present to deny that

¹ *Text-book of Physiology*, Schäfer, vol. i. pp. 594, 595.

² *Uric Acid in Disease*, A. Haig, 1897, p. 609.

proteid may, to some extent, increase also the katabolism of tissue nuclein and the consequent formation of uric acid.

Nor, I think, can the actually diminished excretion of uric acid, observed by Camerer to follow a non-nitrogenous meal, be held to be inconsistent with increased formation of uric acid from digestive leucocytosis. For a purely carbonaceous meal will doubtless raise the carbon contents of the blood, even in spite of succeeding increased combustion, and thus, conformably with the previous generalization, cause diminished renal excretion of uric acid and retention in the blood.

§ 634. There seems little doubt, therefore, that uric acid excretion depends, both directly upon the introduction of uric acid-forming material, and inversely upon the carbon contents of the blood. Thus there will be at least a double column of variations in the excretion of uric acid. But since, on a mixed diet, the introduction of uric acid-forming material is concurrent with the increase of the carbon contents of the blood which is due to meals, it follows that the opposite variations in the excretion of uric acid, due respectively to these two factors, will overlap and tend to obscure each other.

If it is desired to throw into bold relief the variations due to the one factor, the variations due to the other must be eliminated as far as possible. Haig's main object in treatment is to avoid the introduction, with the food, of uric acid or uric acid-forming material : for which reason, it seems to me that in Haig's investigations those variations in the excretion of uric acid which are due to variations in the carbon contents of the blood stand out more prominently than they do in the investigations of other observers who have worked at this subject.

We have already (§ 5) arrived at the general conclusion that nitrogenous katabolism precedes and determines nitrogenous excretion, but I was careful to point out that this law applies only to the katabolism of proteid and the excretion of urea. We now see that, though the katabolism of nucleoproteid and other uric acid-forming material determines the formation of uric acid, yet such katabolism does not by any means necessarily determine the excretion of uric acid. The excretion depends to a large extent inversely upon the carbon contents of the blood, and thus follows, in great part, carbonaceous katabolism and excretion.

§ 635. URIC ACID EXCRETION DURING STARVATION.—It has been argued that, during starvation, the variations in the carbon contents of the blood are abolished, and that a certain uniform level in the composition of the blood, as regards carbonaceous material, is then maintained (§ 187) ; and it requires no argument to show that, during starvation, the introduction of uric acid-forming material ceases. Hence both factors which ordinarily tend to cause variations in the excretion of uric acid will be in abeyance during starvation ; and we shall expect to find, under these conditions, a tendency to uniformity of excretion. This expectation is borne out on appeal to observation ; for ‘ Maress¹ has found that every individual excretes after the thirteenth hour of fasting an almost constant amount of uric acid’ (Levison).

The starvation experiments referred to here clearly show that ‘nearly half the normal uric acid secreted is due to the destructive metabolism of the bodily tissues, the *endogenous* uric acid of Chittenden’² (Woods-Hutchinson).

SIGNIFICANCE OF URO-LITHIASIS

§ 636. Though it is doubtless true, on the one hand, that uro-lithiasis may occur in the absence of excretion in excess, and, on the other, that uric acid may be passed in large quantities without giving rise to any deposition, yet it will not, I think, be denied that, in many instances if not in the majority, uro-lithiasis indicates excretion in excess and represents the releasement of a pre-existing, or co-existing, uricaemia. Thus Charcot says :³—‘ It has been shown that, in certain subjects, gravel is associated with the existence of an excess of uric acid in the blood.’ Dr. Ball⁴ related the case of a man of 64, who had never shown any symptoms of gout or albuminuria, but who frequently passed small uric acid calculi after violent nephritic colic. In his case, ‘ a blister having been applied to the epigastric region, the presence of a notable quantity of uric acid was made out in the serum derived therefrom.’⁵ But the view that uro-lithiasis frequently means excretion of uric acid in excess rests, in the main, upon the fact that uro-lithiasis is especially prone to occur under those

¹ *Uric Acid Diathesis*, Levison, 1894, p. 19.

² Woods-Hutchinson, *Lancet*, January 31, 1903, p. 289.

³ *Lectures on Senile Diseases*, Charcot, New Syd. Soc., p. 10

⁴ *Ib.*

⁵ *Ib.*

conditions which have been shown, by quantitative urinary analysis, to increase the uric acid output.

§ 637. DAILY FLUCTUATIONS IN EXCRETION OF URIC ACID.—We have seen that the rise of combustion between 4 A.M. and 7 A.M. is responsible for the increased excretion which Haig has shown to occur between these hours (§ 615); and it is in the morning urine that uro-lithiasis is most apt to occur. That it occurs less frequently later in the forenoon, when combustion is still higher and when we know that the excretion of uric acid is actually greater, is probably accounted for by the solvent power of the alkaline tide.

§ 638. MENSTRUAL FLUCTUATIONS IN EXCRETION OF URIC ACID.—We have noted the statement of Haig that there is a diminished excretion of uric acid just before, or at the beginning of, the menstrual period, followed by a corresponding plus excretion during the period and just after its termination (§ 616); and it is a fact, which I think has been frequently observed but of which I can find no record, that many women, whose urinary excretion is ordinarily clear and free from all deposit, are liable to suffer from uro-lithiasis at every menstrual period. I am indebted to Dr. Lilian Cooper of Brisbane for observations on this point.

§ 639. PHYSICAL EXERCISE AND URIC ACID EXCRETION.—We have agreed, on the authority of Ewart, Levison, and Haig, that physical exercise increases the excretion of uric acid (§ 617); but we have accepted the amendment of Hutchinson, that such increase is merely temporary, explaining this on the ground that the increased excretion represents the releasement of a prior retention. Conformably, it will be found that, in the cases in which physical exercise is followed by uro-lithiasis, such exercise has, for the most part, been preceded by a period of physical inactivity; for regular physical exercise is one of the best methods of putting an end to recurrent or habitual uro-lithiasis.

It is usually assumed that exercise leads to uro-lithiasis by diminishing the urinary water, through free perspiration: this is doubtless true, but it is manifestly not the whole, nor even the chief part of, the truth.

§ 640. THE PAROXYSMAL NEUROSES AND URIC ACID EXCRETION.—We have seen that the attacks of these affections (migraine, asthma, epilepsy, gastralgia, etc.), especially when

severe, are apt to be associated with increased excretion of uric acid towards the end of, or after, the paroxysm; and it is at these times that uro-lithiasis is often to be noticed.

Of migraine, Möllendorff says:¹—‘The day after the attack it’ (the urine) ‘is dark, with a sediment of urate of soda.’ During and after attacks of asthma, the urine is often dark in colour, and on cooling copious uratic sediments are apt to be deposited. The same may happen, as already pointed out (§ 624), after a severe paroxysm of gastralgia.

In major epilepsy, the excess excretion of uric acid, which Haig has shown by quantitative analysis immediately succeeds a fit, is sometimes manifested as a deposit. The last-mentioned author refers to one case in which a copious deposit of colourless lozenges of uric acid appeared in the urine which had collected in the bladder of an epileptic patient during a severe seizure.² But uro-lithiasis after epileptic fits cannot be regarded as a common occurrence: this, I think, is susceptible of a simple explanation. C. A. Herter and E. E. Smith, commenting upon Haig’s work, admit that the post-epileptic urine is apt to show a higher uric acid ratio than that which is passed just before a seizure; but they maintain that very often ‘the ratio is one that belongs within the limits of health.’³ This is what we should anticipate on the theory that the post-epileptic excess excretion represents the releasement of a prior hyperpyraemic retention. Physiological exercise, as we have seen, effects the same releasement; and the amount of the resulting excess of uric acid excretion depends, *inter alia*, upon the infrequency of the exercise (§ 617). So with the pathological exercise of a convulsion: the amount of the post-epileptic excess of uric acid excretion will depend, *inter alia*, upon the infrequency of the attacks. But epileptic fits tend to be increasingly frequent; and it is highly improbable, for obvious reasons, that in the cases selected for urinary analysis the fits occurred only at rare intervals. Such, however, are the only cases in which we should expect a large post-epileptic excess in uric acid excretion, with consequent uro-lithiasis. Clinical confirmation of this expectation is not difficult to find.

A patient of mine, a gentleman, aged 48, suffers once or twice yearly from a series of epileptic convulsions of great severity: the

¹ *Megrin and Sick-headache*, Liveing, 1873, p. 312.

² *Uric Acid in Disease*, Haig, 1897, pp. 211, 212.

³ *Ib.* p. 216.

series usually consists of two or three attacks, separated from each other by an interval of about an hour. Marked uro-lithiasis follows invariably.

In assuming that uro-lithiasis is an indication of excess excretion in all the above cases, certain reservations must be made. In all the paroxysmal neuroses referred to, profuse diuresis is liable to arise, during some part of the attack or directly after: Liveing¹ points this out in migraine: Salter,² in asthma and epilepsy; and I have seen the same myself in many other neuroses. This polyuria may be fully explained by the extensive vaso-constriction common to all these affections—a vaso-constriction in which the renal arteries do not share; for the same may be observed during the ague paroxysm.³ Now it may be that this polyuria, which, when it occurs, always, so far as I can discover, precedes the uro-lithiasis, depletes the vascular system of water to such an extent, that the amount required for the solution of uric acid, even in normal quantity, is not forthcoming. Again, in those of the paroxysmal neuroses in which acarbonization is achieved mainly by increased physical exertion (*e.g.* asthma and major epilepsy), it may be that profuse diaphoresis has a similar effect. But, after making full allowances for the influence of diuresis and diaphoresis, we must admit that, in many, if not most, cases, the uro-lithiasis indicates excretion in excess, depending on the retention of hyperpyraemia and on its releasement by acarbonization of the blood; for uro-lithiasis may follow in cases which have exhibited no increase of diuresis or diaphoresis.

§ 641. PYREXIA AND URIC ACID EXCRETION.—Fagge⁴ says that in pyrexia there is to be observed ‘scanty and high-coloured urine, rich in urea, often albuminous and depositing lithates’: Bristowe⁵ says the ‘urine is scanty, high-coloured, of high specific gravity, and deposits on cooling a more or less abundant sediment of urates and perhaps uric acid.’

It will be found that these urinary characteristics affect chiefly, but by no means solely, the initial and early convalescent stages of pyrexia—those stages in which, as we have seen, there is apt to be excretion of uric acid in excess (§§ 626, 627). But uro-lithiasis may occur, more or less, throughout

¹ *Megrin, etc.*, 1873, pp. 149, 150.

² *On Asthma*, 1868, p. 29.

³ *Megrin and Sick-headache*, Liveing, 1873, p. 408.

⁴ *Text-book of Medicine*, 1891, vol. i. p. 41.

⁵ *Treatise on Medicine*, 1884, p. 108.

the pyrexial stages : then, it seems to me, the deposits do not indicate excess excretion, but result from the diminution in the excretion of urinary water or retention of water in the system, which has so often been inferred and which is explicable by the general vaso-dilation and consequent tendency to low general blood-pressure characteristic of pyrexia.

Uro-lithiasis occurs towards the end of the pyrexia associated with the acute gouty attack, at the time when Garrod¹ and others have demonstrated that uric acid is being excreted in excess : in subacute gout, but then ‘only after some febrile paroxysm.’² And Murchison says:³—‘Every one . . . is familiar with the copious deposits of lithates which are so common during an attack of ordinary febrile catarrh.’

Uro-lithiasis will naturally be especially marked where pyrexia supervenes in conditions associated with excess of uric acid in the blood. Of the granular contracted kidney, a degenerative affection which, I shall argue later (§ 885 *et seq.*), depends upon, and may continue to be associated with, chronic hyperpyraemia and chronic uricaemia, William Roberts says:⁴—

When there is intercurrent pyrexia . . . the urine may be high-coloured and turbid from lithates.’

§ 642. DISORDERS ASSOCIATED WITH RETARDED COMBUSTION AND URICAEMIA.—Evidence has been adduced to show that deficient combustion, by leading to hyperpyraemia, conduces to uricaemia by causing retention of uric acid in the blood. In chronic disease associated with deficient combustion, there will be a tendency to continuous uricaemia—there will usually be an accumulation of uric acid in the blood awaiting the opportunity of freer elimination, through acarbonization, or partial acarbonization, of the blood. Sooner or later, the latter will probably occur ; for there are so many means, physiological, pathological, and therapeutic, by which it may be accomplished. Then, it seems to me, there will be a more or less sudden urinary excretion of uric acid in excess, sufficient probably, in many cases, to cause uro-lithiasis. Such, I imagine, is the explanation of the frequent tendency to uratic deposits, observed ‘in all conditions in which there is respira-

¹ *Gout and Rheumatic Gout*, 1876, p. 133.

² *Ib.* p. 48.

³ *Functional Derangements of the Liver*, 1874, p. 65.

⁴ *Urinary and Renal Diseases*, 1885, p. 460.

tory insufficiency,'¹ such as chronic bronchitis, emphysema, anaemia, etc. (Rieder and Delipine).

§ 643. GLYCOSURIA AND URICAEMIA.—Garrod says :²—'I have known several instances of patients previously suffering from gravel and calculi, who have lost all traces of these ailments on the supervention of diabetes : an exchange of a lesser for a greater evil.'

The dispersion of uro-lithiasis by glycosuria can hardly be explained by a reduction of the amount of uric acid passing through the blood, since the dietetic management of the latter affection commonly involves an increased intake of uric acid-forming material. It might, however, be explained in one of two ways : (1) by acarbonization precluding hyperpyraemia and uricaemia from retention, and consequently the sudden recurrent releasement and excretion in excess, of uric acid ; or (2) by the diuresis of glycosuria precluding precipitation of uric acid.

§ 644. DIETETIC TREATMENT.—Important evidence that uro-lithiasis is frequently an indication of excess excretion of uric acid depending upon prior retention is to be obtained from observations on the influence of diet. Many of the patients whom I have treated for obesity, migraine, asthma, etc., were habitual sufferers from uro-lithiasis ; and, with very few exceptions, the dietetic treatment prescribed dispersed forthwith the urinary deposits. This treatment consisted in the restriction of carbonaceous, more especially carbohydrate, foods, together with some increase (at times considerable) of meat. In many cases, a return to previous food-habits brought with it a return of the deposits.

It may be that, in some of these cases, the dispersion of the deposits was due to the solvent power of large draughts of hot water which were part of the dietetic plan ; but this was not true of all. For the urine remained clear in many where no extra fluid was taken, and even in some in which the quantity of urine passed was considerably reduced by exercise and free perspiration. Nor could the cessation of the deposits have been due in any case to diminished introduction of uric acid-forming material into the system ; since the introduction of food-stuffs, such as meat, fish, soups, gravy, etc., rich in uric acid-forming material, was, in practically all cases, distinctly

¹ *Atlas of Urinary Sediments*, Rieder and Delipine, 1899, p. 26.

² *Gout and Rheumatic Gout*, 1876, p. 478.

increased. It could only have been due to the avoidance of hyperpyraemia, whereby retention in the blood and the necessity for subsequent excretion in excess were obviated—to rapid elimination, in short.

The observations of many authorities may be adduced in support of these views. Goodhart refers to a case in which milk and rice-pudding increased uro-lithiasis, which was promptly dispersed by the substitution of a meat diet; and, in the case of children who suffer from this disorder, he recommends an increase of meat and water, with a corresponding diminution in the quantity of starch-foods. Wharton Sinkler says: ¹—‘Lithaemia ² may exist in children as well as adults.’ He advises abundant exercise, care in diet, and alkaline waters. ‘Starchy and saccharine food should be avoided by those who show any tendency to lithaemia, such as brick-dust deposit in the urine, coated tongue, and heavy breath. The habit of giving children an excess of starchy food combined with sugar tends to produce lithaemia. It is very common to find that children, even up to 12 or 14 years of age, habitually make a breakfast consisting almost entirely of oatmeal or some porridge with cream and large quantities of sugar, to which is added some griddle cakes and syrup.’ Of uro-lithiasis in the adult, Murchison says: ³—‘As a rule, those articles of diet are most apt to disagree which contain much saccharine or oleaginous matter, and not, as might perhaps have been expected, nitrogenous food, if plainly cooked.’ W. Bezly Thorne, ⁴ speaking of the management of cases in which there is evidence of intestinal fermentation, advises the omission from the dietary of carbohydrates and hydrocarbons, and adds:—‘That precaution observed, no fear need be entertained of aggravating the uric acid diathesis by means of nitrogenous food. Uric acid, in many instances, readily disappears under the influence of a diet of diabetic severity.’

One of my cases (Case XXVIII) had suffered intermittently for some years from symptoms suggestive of renal calculus, but he had

¹ Hare’s *System of Therapeutics*, vol. iii. p. 390.

² Lithaemia is the term applied by Murchison to the hypothetical condition of the blood responsible for the frequent occurrence of uratic deposits in the urine: it is not identical with uricaemia, but, as I am arguing throughout this work, with hyperpyraemia, which, probably, always implies a certain degree of uricaemia (§ 858 *et seq.*).

³ *Functional Derangements of the Liver*, 1874, p. 70.

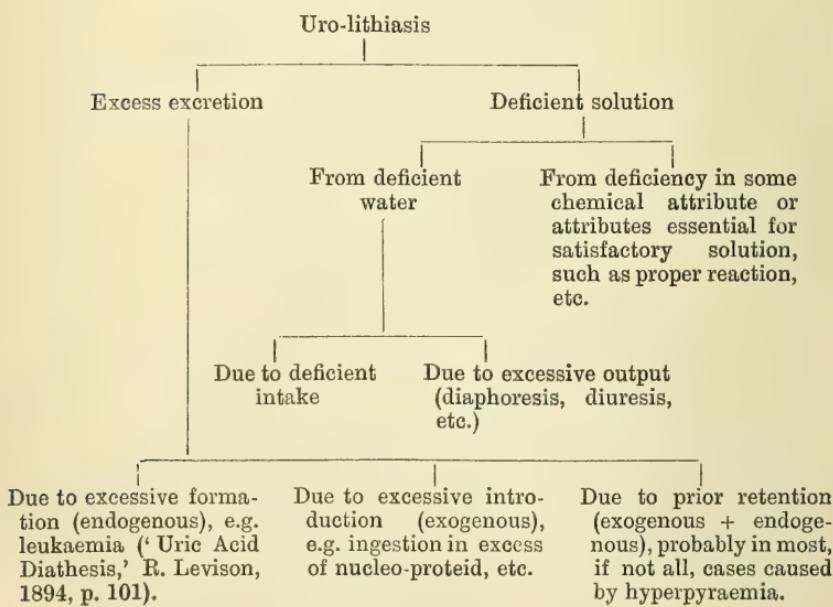
⁴ ‘Self-poisoning in Heart Disease,’ *Lancet*, 1896, March 21.

never suffered from renal colic. In his case, the enforcement for two months of a moderate diabetic diet was followed by a violent attack of renal colic and the passage of a small uric acid calculus. Thereafter, he ceased to suffer from the symptoms of renal calculus. I do not lay much stress upon this incident: quite probably it was a mere coincidence, but it happened also in another (Case LXXIX).

At the same time, it is only fair to admit that a diet consisting of a large proportion of meat, even when the purely carbonaceous food-stuffs have been largely reduced, may be followed by uro-lithiasis, not previously noticed: I have seen several such. In some, the addition of extra fluid has cleared up the deposits; but, in others, they have persisted and a reduction of the amount of meat has been demanded. In these latter, at least, there can be no doubt that the deposits depended upon excessive excretion due to excessive introduction of uric acid-forming material. But in all such cases, the intake of material has been considerable: not, in any case, less, I believe, than one pound of lean meat (cooked) per diem, and in some cases considerably more.

§ 645. EPITOME.—In the following table I have attempted to epitomize the various probable factors in uro-lithiasis.

TABLE IV.



It is highly probable that in many, if not most, cases, urolithiasis is due to some combination of these factors: for example, in the uro-lithiasis which follows severe unaccustomed physical exercise, there may have been previously an excessive introduction of uric acid-forming material and a retention of uric acid in the blood from hyperpyraemia or a tendency thereto, while the excess excretion, which follows the decarbonization of physical exercise, is probably associated with deficient urinary water, caused by excessive diaphoresis.

RELATIONS OF URO-LITHIASIS TO GOUT AND TO FUNCTIONAL DERANGEMENTS OF THE LIVER

§ 646. The conclusion we have reached, that uro-lithiasis, in many cases, indicates the dispersion of a pre-existing hyperpyraemia, enables us to understand (1) the relations between gout and calculus; and (2) the relations between functional derangement of the liver and the habitual, or frequent, occurrence of uratic deposits in the urine.

1. Gout depends upon hyperpyraemia and is a *means* of acarbonization: uro-lithiasis may depend upon hyperpyraemia and is, in many cases, a *result* of acarbonization; and it will be admitted that uro-lithiasis, occurring in the urinary organs or passages, is an important factor in calculus. Hence some persons, like Sydenham, suffer from gout and calculus concurrently. But gout is only one amongst many acarbonizing processes depending on hyperpyraemia; and uro-lithiasis may occur independently of hyperpyraemia. Hence many persons suffer from calculus, who have no tendency to arthritic gout. Indeed, the general rule would seem to be that where stone is common, gout is rare; and conversely.

2. Glycogenic distension of the liver is often, as already argued (§ 92 *et seq.*), an indication of hyperpyraemia: it is also, according to our views, a common form of functional hepatic derangement. Hence its frequent association with uro-lithiasis—an association upon which Murchison founded his theory of 'lithaemia.'

URIC ACID AS A FACTOR IN DISEASE

§ 647. There is no doubt that uricaemia, in some degree, is associated with many different clinical conditions, physiological

as well as pathological; and it is clear that it may be, in great part, due to retention in the blood, its subsequent dispersion being due to adequate renal elimination. To what extent, however, can it be said that uric acid is a factor in disease?

In the gouty paroxysm, there is primarily hyperpyraemia and secondarily uricaemia. Uric acid is clinically conspicuous: through its eruption from the blood-stream, it becomes the proximate factor of the pyrexia and so the instrument whereby the blood is relieved from the associated conditions of hyperpyraemia and uricaemia. Here, it is obvious, uric acid plays the part of a conservative pathological agent.

I shall argue later (§ 843) that in chronic gout uric acid fails as a conservative agent: that, in consequence of the failure of pyrexial acarbonization, the uricaemia persists; and that uric acid continues to be poured out from the blood and accumulates in the tissues extra-vascularly. Here, then, uric acid is clearly an important factor in the characteristic crippling of the disease: it is pathological, but not conservative.

In uro-lithiasis and in most urinary calculi, there is no question that uric acid is an essential factor. But, in all these cases (and possibly in others), whether its effect is conservative as in acute gout, or merely deleterious as in chronic gout, uro-lithiasis, and calculus, the salt acts as a mechanical irritant. Is there any evidence tending to show that uric acid acts deleteriously upon the organism while it remains in solution in the blood? Later (§ 891) I shall suggest that the excretion by the kidney of uric acid under hyperpyraemic conditions involves a certain degree of damage to the glandular tissue of the organ, and that such damage, when frequently repeated or prolonged, becomes the starting-point of some cases of renal degeneration; but, even here, a doubt will remain as to whether the damage is not incurred through the mechanical irritation of the precipitated acid. But, apart from this doubtful instance, I am unable to find any evidence that uric acid is capable of giving rise to symptoms, subjective or objective, or of leading to pathological consequences, so long as it remains in solution in the blood.

The hypothesis that headache depends upon uricaemia is, to my mind, untenable. It is true that, up to a certain point, the migrainous paroxysm offers an exact parallel to the gouty

paroxysm: there is primarily hyperpyraemia and secondarily uricaemia. But the carbonaceous accumulation induces what may be termed a vaso-motor explosion and so brings about its own dispersion and, incidentally, that of the uricaemia. And so with epilepsy, asthma, and probably other paroxysmal neuroses: the uricaemia constitutes an unimportant incident in the process—it is a mere symptom, that is to say.

CHAPTER XVI

§§ 648–682

Recurrent hyperpyraemia ; or hyperpyraemia interrupted by recurrent pathological acarbonizing processes, depending on hyperpyraemia (*cont.*)—Catarrhs : variations in combustion : daily fluctuations in the carbon contents of the blood : menstrual fluctuations : pregnancy : fat-formation : pyrexia : glycosuria : lithaemia and the gouty diathesis : paroxysmal neuroses : self-curative influence of acute catarrhs : food and dietetic treatment—Relation between acute bronchitis and asthma—Some other pyrexial acarbonizing processes : acute rheumatism : recurrent febricula : some erysipelatoid affections—Recurrent ‘idiopathic’ haemorrhage : vicarious menstruation : modern tendency to deny the existence of vicarious menstruation : conservative haemorrhagic acarbonization, not substitutive of the menstrual process : mechanism and immediate medical treatment of ‘idiopathic’ and other haemorrhages—Summary.

CATARRHS

§ 648. Most catarrhs, at least such as are at all acute, tend to be pyrexial in nature, and may probably be regarded, therefore, as acarbonizing processes ; and if it can be shown that hyperpyraemia enters into their causation, then we shall be entitled to regard them as conservative processes adapted to disperse this condition of the blood. Nor shall we necessarily be precluded from continuing to hold this view even when it has been demonstrated that many of these processes have microbic infection for an essential factor ; for it will still be open for us to regard the hyperpyraemia as the predisposition to the infection.

It would appear that under the clinical term ‘catarrh’ are grouped a number of pathological processes differing materially in their causation. The popular idea is that catarrh results from ‘catching cold,’ and there can be no doubt that the popular idea is often correct. A chill to the surface causes cutaneous vaso-constriction, and cutaneous vaso-constriction is apt to be associated with, or compensated by, some internal area of vaso-dilation. Vaso-dilation necessarily leads to active hyperaemia or congestion, and this passes by insensible grada-

tions, both clinically and anatomically, into inflammation. Should this internal vaso-dilation affect a mucous membrane, say for example any portion of the respiratory mucous membrane, and should it be sufficiently intense and persistent, we may have the condition known as catarrh or catarrhal inflammation. Such a catarrh may be regarded as a secondary result of cutaneous vaso-constriction: thus its pathology would harmonize with popular ideas.

But it does not follow that all catarrhs are secondary to vaso-constriction. Some physicians are of opinion that catarrh may arise through a sudden change from a cold to a warm temperature, as in entering a hot room on a frosty night: in this case, the primary alteration of vascular balance would probably be dilative. And catarrhal conditions, indistinguishable from ordinary catarrhs (though perhaps as a rule more severe), may be due, as in hay-fever, to irritants acting directly upon the mucous membrane which manifests the disorder. Here again, the vaso-dilation is probably primary; and whether it ends in a fugitive congestion (nervous erethism) or graduates into an overt catarrhal inflammation, would seem to depend largely upon the nature, the intensity, and the duration of the irritation. The local irritants already considered are mainly mechanical or chemical, but it is generally admitted that microbial infection may be the proximate factor of many catarrhal processes. The known fact that colds often run through a household, the history of the Ben Nevis and St. Kilda colds, and the experiences of the Nansen expedition to polar regions, are sufficient to prove that in many cases catarrh is a matter of infection.

Now, without questioning that very often infection or other external factor may be sufficiently intense to induce catarrh in those who are in perfect physiological health, we shall have to admit that, in some cases, a personal predisposition is a factor in causation; for the incidence of catarrh—even of catarrh which is manifestly infectious—is very unequal, many persons who are freely exposed invariably escaping. And it will not, I think, be difficult to show that, in some cases, the predisposing factor consists of the blood-state we have termed hyperpyraemia. The evidence in support will now be considered: it is essentially similar to the evidence adduced in favour of the hyperpyraemic origin of the affections already dealt with.

§ 649. VARIATIONS IN COMBUSTION.—Physical exercise, as so often insisted, is one of the most physiological methods of decarbonization; and regular physical exercise in the open air and all occupations entailing it admittedly confer a high grade of immunity against catarrhal affections. The same hygienic conditions may be successful as therapeutic measures in dispersing existing catarrhs. On the other hand, habitual sufferers from catarrh are found chiefly amongst those who lead an indoor sedentary life.

Of hay-fever, Fagge says:¹—‘One very curious circumstance about this disease is that those who suffer from it appear always to belong to the educated classes. It is never seen amongst gardeners or farm labourers, who are of course more exposed to the influence of pollen than any other set of men. This fact has led to the suggestion that the individual predisposition to the disease, which plays so important a part in its etiology, is perhaps a result of an indoors life, especially in towns and cities. Should this be the case, one can understand how it is that hay-fever appears to have become so much more common of late years than in the earlier part of the present century.’

§ 650. DAILY FLUCTUATIONS IN CARBON CONTENTS OF THE BLOOD.—The symptoms of most catarrhal affections, such as coryza and bronchitis, like those of asthma, tend to vary, for the most part, inversely with the daily fluctuations of combustion, or directly with the daily fluctuations in the carbon contents of the blood. A marked exception to this is found in hay-fever, which is commonly most severe in the morning and early forenoon: this is due, possibly, to the incidence of the external factor.

The catarrhal croup of childhood almost invariably commences, or attains its climax, some hours after the child has gone to bed at a time when combustion is falling or low. That this recurrent affection depends upon a localized vaso-dilation due to hyperpyraemia seems highly probable. It may be regarded as one of the juvenile variations of ‘spasmodic’ or nervous asthma. It occurs in children who usually present ‘symptoms² of nerve-disorder, other than this tendency to spasm’: the catarrhal symptoms which may precede, accompany, or succeed the spasm, occur also in many instances of

¹ *Text-book of Medicine*, 1891, vol. i. p. 1105.

² *Diseases of Childhood*, Donkin, 1893, p. 343.

'spasmodic' asthma; and pyrexia is liable to complicate any of the neuroses of childhood. It has been pointed out that the dyspnoea is well adapted to increase the expenditure of carbon and so to disperse hyperpyraemia (§ 264).

§ 651. MENSTRUAL FLUCTUATIONS IN CARBON CONTENTS OF THE BLOOD.—Dr. Helen McMurchy finds that 47 out of 100 *healthy* women are peculiarly liable to catarrh at each menstrual period.¹ In my experience, this increased monthly susceptibility affects chiefly the immediately pre-menstrual period and the first day or two of the period, about the time when the inter-menstrual carbonaceous accumulation attains its highest point. In many cases, the so-called catarrh consists merely of a fugitive erethism of the nasal mucosa, occasioning a 'stuffiness' hardly worthy of the name of cold; but all gradations are to be met with, between this and overt nasal catarrh.

Dr. Hawkes has a lady patient who suffers from hay-fever through the six summer months in Queensland; but during this season the attacks are limited to the day before, and the first day of, menstruation: they invariably cease on the second day of the process.

§ 652. PREGNANCY.—Sir F. W. Wade² calls attention to the popular opinion that pregnant women are to a large extent immune against colds and other analogous disorders. It has been argued that there is increased decarbonization of the blood throughout the whole of pregnancy.

§ 653. FAT-FORMATION.—Though I am unable to quote authorities in my support, I have a firm conviction that, other things being equal, persons with a well-developed fat-forming capacity suffer relatively little from catarrhal affections. At least I know of many persons who were habitually catarrhal, so long as they remained thin, but who ceased altogether to suffer in this way after becoming stout. The following is a case in point:—

A lady of 22 had for some years been thin, not anaemic, and had suffered from frequently recurring catarrh, nasal, faucial, laryngeal, and tracheal. On some occasions, the catarrh extended into the larger bronchial tubes. She was especially liable to be attacked at

¹ *Lancet*, October 5, 1901.

² *British Medical Journal*, 1872, vol. ii.; referred to by Haig, *Uric Acid in Disease*, 1897, p. 127.

the menstrual period. Her physician advised her a change of air from Brisbane to the Blue Mountains in New South Wales. Very shortly after her arrival in that district, all tendency to catarrh ceased. Concurrently, she rapidly increased in weight. Six months after her return she remained absolutely well, except for some anxiety through fear of early obesity.

§ 654. PYREXIA.—It has long been recognised that pyrexial patients are not liable to 'catch cold.' Full advantage of this immunity has been taken by those who advocate refrigeration in fever, and especially by the advocates of the cold-bath treatment of typhoid. The high temperature itself has been regarded as the defensive agent: this is possibly true in part; and very probably the condition of vaso-motor paresis does not lend itself readily to the production of catarrh. But it seems most likely that the exaggerated combustion is the fundamental factor—that the ensuing acarbonization of the blood removes the predisposition to catarrh, as it does to so many other affections depending on hyperpyraemia.

During the pre-paroxysmal period of recurrent gout, catarrhal inflammations of many kinds are common: these may be ascribed to the hyperpyraemia which is leading up to the arthritic outbreak. Amongst such inflammatory affections has been often observed, according to B. London,¹ 'a urethritis, strikingly like gonorrhoea, without the presence of gonococci; and this occurred in arthritic patients in whom a gonorrhoeal infection has never been present. The arthritic nature of the disorder was evidenced by its course, by its appearance immediately before an attack of gout, and by its spontaneous disappearance after the articular trouble was over.' Such urethritis has been ascribed to the local irritation caused by the passage of urine rich in uric acid. But this seems improbable, since it is during the immediately pre-paroxysmal period of arthritic gout that the urine is poorest in uric acid.

§ 655. GLYCOSURIA.—I have no observations tending to show that diabetics, or persons suffering from glycosuria, are immune from catarrh; but I have known a tendency to frequent catarrh disappear at the onset of glycosuria.

§ 656. LITHAEMIA AND THE GOUTY DIATHESIS.—These terms may be regarded as synonymous; and, later, I shall

¹ 'Treatment of Gout at Carlsbad,' B. London, *Practitioner*, August 1903, p. 176.

argue that both are identical with hyperpyraemia (§ 858 *et seq.*). Of lithaemia, Murchison says: ¹—‘Having paid considerable attention to the matter, I am satisfied that persons with the lithaemic dyscrasia are much more prone than others to ordinary febrile colds, as well as to more severe local affections.’ In this opinion Duckworth ² fully concurs: the special proclivity he ascribes either to ‘inherited tissue-peculiarities’ or to ‘the altered blood-condition which may supervene from time to time.’

Of the gouty diathesis, Duckworth says: ³—‘Noel Gueneau de Mussy was of opinion that many cases of hay-fever were especially frequent in members of gouty families. . . . He recorded ten cases in illustration of this. I have sometimes noted the connexion.’ I have already referred to a case in which long-recurrent hay-fever and hay-asthma were replaced permanently by acute recurrent gout (§ 519).

§ 657. PAROXYSMAL NEUROSES.—Sufferers from frequently recurring frank neurosal paroxysms, which, we have agreed, depend in many cases upon hyperpyraemia and acarbonize the blood, seem to be less liable to catarrh than the average person.

A hospital nurse, aged 39, an almost lifelong sufferer from migraine of a severe type, can only call to mind one or two colds during the last seven or eight years: during this time, she has had violent migraine (with complete anorexia) every two or three weeks. At a previous period of her life, migraine affected her but rarely, about once in six months: then she suffered from frequently recurring catarrh of a severe influenza type.

Sometimes migraine and catarrhs occur frequently in the same individual: in such cases, they alternate as a rule, and do not concur. One of my patients, when he takes a holiday from his very sedentary occupation, ceases to suffer from migraine, but usually catches a cold. In only one case have I known well-developed migraine and severe catarrh to be concurrent; but I have met with several in which attacks, commencing as migraine, have terminated on several occasions in severe colds.

A medical man suffered habitually from premonitory symptoms before his migraine developed. These symptoms were uniform and included a slight but peculiar form of headache: they invariably led up to a typical migraine paroxysm, except on the occasions to which

¹ *Functional Derangements of the Liver*, 1874, p. 85.

² *Treatise on Gout*, 1890, p. 208.

³ *Ib.* p. 219.

I am referring. On these, the premonitory symptoms endured for two days as usual, but ended on the third in a severe influenza cold with sore throat and general malaise.

A lady of 22 gives the following history :—

For almost as long as she can remember up to the age of 18, she was tormented by very frequent catarrhs of a severe type, affecting the eyes, nose, fauces, pharynx, larynx, and trachea. Four years ago she developed recurrent nocturnal asthma. Since that time, she has had no more than one or two slight attacks of catarrh.

Dr. Hawkes contributes the following case :—

A gentleman, the father of a large family, is suffering from general paralysis. A special feature of the case consists of rather severe, more or less regular, epileptiform convulsions. In Brisbane, at certain seasons, febrile catarrh (influenza ?) assumes almost epidemic proportions, frequently running through a whole household. The wife of the patient informed Dr. Hawkes of her own accord, that, since the commencement of the fits, her husband had suffered from no sign of catarrh, although every other member of the household had been attacked more than once during this period, and although he himself had previously shown no such immunity.

The tendency to alternation between neurosal paroxysms and catarrh has recently been brought forward by George M. Gould¹ in his series of articles on the *rôle* of eye-strain in civilization. Referring to the late Mrs. Carlyle, who suffered a lifelong martyrdom from migraine, he says :—‘ When not suffering from headache, she was always suffering from colds or influenza—“ eight influenzas annually,” said Miss Martineau, . . . It is noteworthy that these colds and influenzas did not coexist usually with headache and sick-headache.’

Gould infers that, in this patient’s case, the frequent catarrh, not less than the migraine, was the result of eye-strain. It has been admitted that catarrh is, in many cases, primarily a vaso-motor affection ; also that eye-strain, by exalting vaso-motor irritability, may determine pathological prepotency or relative hyperpyraemia (§ 545 *et seq.*). Hence we are not called upon to exclude the influence of eye-strain in predisposing to catarrh.

§ 658. THE SELF-CURATIVE INFLUENCE OF ACUTE CATARRHS.
The after-effect of acute catarrh is consistent with the theory

¹ *Brit. Med. Journal*, September 26, 1903, p. 757.

that hyperpyraemia is a factor in causation. Being pyrexias, catarrhs would operate to promote acarbonization, though, like the paroxysmal neuroses, they would be efficient in varying degrees: thus they would tend to remove temporarily the predisposition. Conformably, after the crisis or abatement of a severe feverish cold, there may be a sensation of manifest comfort and well-being, as prominent subjectively as that which follows a neurosal paroxysm: sufferers from catarrh, especially severe catarrh, often say, 'a load which was oppressing them has been removed,' or use some similar phrase. Such catarrhs, therefore, may be regarded as self-curative in the same sense as the paroxysmal neuroses and gout are self-curative; and as with these affections, it may often be observed that the period of immunity which follows is apt to be roughly proportionate to the severity of the attack: some persons have almost constant catarrh of a mild grade, others suffer infrequently, but severely.

§ 659. FOOD AND DIETETIC TREATMENT.—Towards the end of an epistolary discussion in the '*Lancet*' on 'the dangers of a common cold,' Dr. John Haddon writes:¹ 'But how can we explain the fact that some are so susceptible, while others never suffer? Since I began to study diet, I have been astonished at the number of cases of which I have heard, even of medical men, who, by eating less and not so often, have found that their susceptibility to cold has quite gone. Such facts as I have met with point to the conclusion that it is the system overcharged with the products of food, which was not required and can only act as a poison to every organ in the body, which is most susceptible to colds. If such be a correct conclusion, it may help us to understand susceptibility as well as immunity, and it is a subject worthy of investigation.'

The dietetic treatment favoured by Dr. Haddon consists, I believe, in a material reduction of proteid: such in many cases may, as already argued, promote acarbonization of the blood through a progressive decrease of carbonization; and no doubt the tendency to catarrh, whether acute or chronic, may often be thus obviated. But the same results, humoral and clinical, may be achieved, I think even more simply, more rapidly and certainly, by restriction of the carbonaceous intake without restriction of proteid. In both cases—in the retardation of the

¹ *Lancet*, February 22, 1902, p. 549.

carbonizing functions and in the diminution of the carbonaceous intake—the results are rendered far more rapid, enduring, and satisfactory, by the decarbonizing influence of physical exercise in the open: indeed, from restriction of proteid I have myself failed as a rule to obtain good results without increased physical exercise. This applies to hay-fever as well as to the simpler forms of catarrh.

The influence of food upon hay-fever was well shown in a case that was being treated by Dr. Hawkes. Under a mainly meat diet, there had been very great improvement for several months. From February 26 to March 3, 1903, that is, during Lent, there was a severe relapse, which was accounted for by the substitution of porridge, milk, and sugar, for meat.

Reference may here be made to the aphorism, ‘Starve a cold and feed a fever.’ If recurrent catarrhs are acarbonizing processes depending on hyperpyraemia, they will manifestly be abbreviated by fasting. On the other hand, the specific fevers, even if it should turn out that they are favoured in the first instance by hyperpyraemia, are apt to persist long after any pre-existing hyperpyraemia must have been dispersed. The exaggerated combustion then feeds, in the main, upon the fixed tissues of the body, and it is reasonable to seek to economize such loss through the substitution of an alternative fuel in the food. It is said that glucose, given to the pyrexial patient, reduces the loss of tissue nitrogen, as well as of tissue carbon.

THE RELATION BETWEEN ACUTE BRONCHITIS AND ASTHMA

§ 660. Just as all gradations between fugitive apyrexial erythema and marked catarrhal inflammation may be observed in the nasal mucous membrane, so apparently with the mucous membranes of the bronchial tubes, large and small. Without questioning the wide clinical, pathological, and etiological differences between the typical forms of asthma and acute bronchitis, it is clear that many intermediate gradations between them are to be observed. Of asthma in infancy, Goodhart says: ¹—‘It shows itself as a bronchitis as far as the physical signs go; but it is a strange and interesting bronchitis,

¹ Clifford Allbutt's *System of Medicine*, vol. v. p. 290.

apart from the physical signs. It comes on with remarkable suddenness: it is mostly associated with fever: it is generally attributed to chill by the relatives; but there are reasons for thinking that it owns a much greater variety of causes. . . . It clears up with remarkable celerity and certainty; it often leaves the child no worse than it was before the attack. Such attacks as these occur in . . . children that give conspicuous evidence either of coming of nervous stock or of nervousness and excitability in themselves. The whole history of these cases is explosive and nervous.'

So much for the nervous side of an apparently catarrhal or inflammatory affection. On the other hand, Berkhardt refuses to regard even the most paroxysmal forms of asthma as 'in any sense nervous': he considers all cases as due to a rapidly spreading catarrh. But it is impossible to ignore the prominence of the nervous element in many cases: I have myself seen a violent asthmatic paroxysm *cease instantaneously*, when the inferior turbinated was touched with chromic acid, and this is no isolated experience. And, on the other hand, catarrhal symptoms, it may be in only slight degree, are present in practically all cases. Consequently, the prominence of the nervous and catarrhal symptoms fails us as a fundamental distinction.

§ 661. It would seem that all cases present nervous and catarrhal features in varying degrees. In both asthma and acute bronchitis, there is a vaso-dilation of the bronchial area: in both, there is swelling of the mucous membrane and, later, an increase in secretion; in both, the anatomical condition leads to obstructive dyspnoea. The essential differences between the two affections consist of differences in the character of the bronchial distension, which is hyperaemic in the one case, inflammatory in the other; and these differences may well be ascribed, in great part, to differences in the nature, intensity, and duration of the proximate factors, or excitants, of the two affections.

In some cases of asthma, more especially such as tend to be regularly recurrent, it seems probable that the proximate factor of the bronchial vaso-dilation is the widespread cutaneous (and perhaps other) vaso-constriction: here the vaso-dilation is secondary and compensatory, being demanded by the necessity for preventing a rise of blood-pressure. In other cases of

asthma, more especially hay-asthma, it seems certain that the proximate factor of the bronchial vaso-dilation is the inhalation of irritant particles : here the vaso-dilation is probably primary, any concurrent vaso-constriction elsewhere being secondary and compensatory, and demanded by the necessity for preventing a fall of blood-pressure.

Similarly with acute bronchitis, the initial bronchial vaso-dilation may be secondary to a chill of the surface or it may arise primarily from the inhalation of irritants, gaseous, particulate, or other ; and we may probably include, amongst such direct excitants, microbic infection.

Now most such excitants are manifestly liable to wide variations in severity: chill may be fugitive and slight, or prolonged and intense : the same is true of inhaled irritants ; and perhaps of microbic infection. Nor can differences in the vulnerability of the tissues in different individuals and in the same individual at different times be left out of account. Hence it may happen that excitants, which are capable of giving rise to a mere fugitive hyperaemia in one person or at one time, are capable of causing overt inflammation in another person or at another time ; and there will be many intermediate gradations between typical hyperaemic asthma and typical inflammatory bronchitis.

Conformably, it was clear, in the early experiments upon the frog's web or mesentery, that hyperaemia graduated insensibly into inflammation. In these experiments, a slight temporary irritation sometimes led to a hyperaemia which rapidly passed off: a more severe or prolonged irritation led to pronounced hyperaemia, which ushered in exudation and all the phenomena of inflammatory reaction¹ (Ziegler).

§ 662. But it is open for us to believe that, not rarely, in both the hyperaemic asthma and the inflammatory bronchitis, whatever the excitant in either case, there is an antecedent humoral predisposition. It has been argued that, in at least some cases of asthma, the predisposition consists of hyperpyraemia ; and it is highly probable that the same is true of some cases of acute bronchitis.

Such cases are usually ascribed to gout: they are regarded as a manifestation of non-articular gout. But although in a few cases of 'gouty laryngitis' deposits of urates have been

¹ *General Pathology*, Ziegler, American edition, 1899, p. 256.

found, yet ‘strict¹ evidence of the occurrence of uratic deposits in connexion with the bronchi is not forthcoming’ (Ewart); and I am referring in this work practically all the manifestations of non-articular gout to hyperpyraemia, which is the necessary antecedent of the acarbonizing paroxysm of acute gout.

Ewart says:²—‘Acute gouty bronchitis is sometimes extremely severe. . . . As a rule, the urgency of the bronchial symptoms bears an inverse ratio to that of the arthritic, the latter tending to remit with the bronchial exacerbations. Occasionally, however, the bronchitis is part of the fit of gout; but much more often it is either a *premonitory* affection, abating somewhat suddenly on the advent of the latter, or it breaks out on the *abrupt cessation* of articular pains. In both cases, it is often accompanied with great constitutional disturbance, hepatic derangement, and irregularity of the heart’s action.’ It might be added to this comprehensive description, that cases of acute bronchitis, equally ‘gouty’ in nature, though probably not diagnosed as such, may occur apart from any articular manifestation, in persons who have suffered at other times from articular gout, or in persons who have never had any joint trouble at all. All such cases are explicable on the supposition that they depend upon hyperpyraemia and are acarbonizing processes or attempts at acarbonization, substitutive, wholly or in part, of true gouty acarbonization.

Harry Campbell³ describes a case in point, in which the success of the treatment adopted demonstrates, to me at least, that hyperpyraemia was an essential factor in the pathology. A stout gouty man of 65 had for years led an active life and been a hearty eater. On retiring from business, he spent most of his time indoors reading and continued to eat and drink in the same hearty way as before. After a time, he developed acute bronchitis which gradually became chronic. He was finally cured (1) by gradually reducing the food almost to the starvation point, (2) by general eliminative measures, and (3) by a graduated course of respiratory exercises. In such a case, we may believe that the patient was suffering from hyperpyraemia (for his conditions of life could hardly have been better adapted to cause this blood-state); and that some chance proximate factor (chill, mechanical irritant, microbic

¹ *Gout and Goutiness*, Ewart, 1896, pp. 207, 208.

² *Ib.* pp. 209, 210.

³ *Lancet*, February 2, 1901, p. 348.

infection, or what not) by its influence, direct or indirect, upon the bronchial mucous membrane, guided the overdue acarbonization into a respiratory channel. That the failure of the ensuing acute bronchitis to restore the blood to its physiological condition and thus to cure itself, was due, in great part, to continued over-feeding, continued over-carbonization of the blood and hyperpyraemia, seems clear from the success of the treatment finally adopted.

Goodhart,¹ protesting against the prevailing dietetic practice in severe illness, says :—‘ You have any one of you seen, if you wake your memory, the big man or woman very ill with bronchitis or heart disease thus loaded up with food and brandy, and where, if they had only been resolutely starved on water only, they might have had a fair chance of a longer life. But alas, so deeply ingrained is this tendency to stuff the sick man, lest he should sink, that I defy anyone to fight effectually against that mighty trio, the patient, the relative, and your own forgetfulness of the belief, nay the knowledge, that is in you.’

SOME OTHER PYREXIAL ACARBONIZING PROCESSES

§ 663. It is, of course, impossible to form any idea at present to what extent hyperpyraemia enters into the predisposition of the numerous varieties of pyrexia, specific and other—to what extent such pyrexias, when intercurrent in hyperpyraemic affections, are specially adapted to disperse hyperpyraemia, or are mere fortunate, or, in some cases, unfortunate, incidents ; but it may be again insisted that the demonstration of an essential microbic factor does not necessarily remove them from the list of pyrexias which might own a hyperpyraemic predisposition.

A single illustration may be given. It will be granted that ague is a specific fever, depending upon the presence in the blood of the plasmodium ; and yet it would seem that, in some cases, a hyperpyraemic condition is no less essential for the continuance, if not for the initiation, of the disease. George Keith² describes the case of a lady who returned from India suffering from tertian ague with extreme debility and emaciation. She was treated on ordinary lines for six months. ‘ Quinine,

¹ An Address entitled ‘ Where Memory sleeps,’ *Lancet*, May 9, 1903, p. 1284.

² *Plea for a Simpler Life*, 1897, pp. 25, 26.

arsenic, and iron had failed, as had wine and all sorts of rich tempting food, but for want of better these were still being pushed.' Keith thus describes his treatment:—' All medicine was stopped and all stimulants: for food she had the well-tried milk, lime water, and white of egg, in very small quantity; and she was kept constantly in bed, and mustard poultices freely used. The fever came every second day as before, but after ten or twelve days her condition otherwise was so much improved that I ventured to give the quinine again in full dose. It at once checked the fever and it did not return. She could soon take a reasonable amount of light food, her strength slowly returned, and in a wonderfully short time she was enjoying very fair health, and returned to India.'

§ 664. ACUTE RHEUMATISM.—Of late years, under the able advocacy of Newsholme, there has been a strong tendency to regard acute rheumatism or rheumatic fever as one of the acute specific infections. Against this view are the fact that an attack, even if severe and prolonged, confers no necessary immunity from subsequent attacks; and the doubtful results of bacteriological investigation.

But since the two are by no means inconsistent, I am less concerned to dispute the existence of a microbic factor, than to determine the presence or absence of a hyperpyraemic predisposition in some cases at least.

§ 665. Consistent with hyperpyraemia is the classification by Carter, in the last edition of his work on medicine, of acute rheumatism amongst diseases due to perverted metabolism: also the view of Goodhart, who is inclined to regard acute rheumatism as a juvenile variety of, or substitute for, acute gout. Goodhart says:¹—' When a man, who in earlier years had acute rheumatism, is attacked in middle age with well-marked gout, we may suppose that a common factor has been modified, so that what did produce acute rheumatism, at a later date produces gout.' Now the evidence in favour of the dependence of acute gout upon hyperpyraemia is probably as strong as in the case of any of the disorders here ascribed to this blood-state, if not stronger.

Bouchard's statistics point strongly to the dependence of acute rheumatism upon hyperpyraemia, or upon the causes of hyperpyraemia. Thus:—

¹ Clifford Allbutt's *System of Medicine*, vol. v. p. 290.

In 100 cases of obesity, acute rheumatism had occurred 31 times.							
" " " gall-stones, "	"	"	"	28	"		
" " " diabetes, "	"	"	"	16	"		
" " " gout, "	"	"	"	9	"		

And all these affections, I have argued or shall argue, depend either upon hyperpyraemia, or upon some of the factors, or some of the results, of hyperpyraemia.

W. Bezly Thorne¹ suggests that 'the affection known as rheumatic fever, the cause and incidence of which have been the subject of so much learned investigation, may . . . be an acute and culminating incident, determined by relatively adventitious circumstances, in a long-protracted course of self-poisoning in which uric acid has played an important part.' The above may perhaps be looked upon as a generalized statement of the view that rheumatic fever is a pyrexial acarbonizing process dependent on hyperpyraemia and determined by the intervention of more or less incidental factors, such as chill from exposure to cold or wet, or possibly microbic infection.

The following interesting observation is suggestive:—

A railway stoker, aged 45, with mitral disease resulting from three attacks of rheumatic fever, had suffered from numerous attacks of articular and muscular rheumatism, not amounting to rheumatic fever, but sufficiently acute to keep him in bed for a week or two. He volunteered the statement that he could invariably foresee the occurrence of these attacks several weeks in advance. His average weight was about twelve stone. For a time he would progressively increase in weight up to about fifteen stone. At that weight he would remain stationary for some weeks, at the end of which period the rheumatic attack would set in. This sequence of events occurred on five different occasions. (Communicated by Dr. Hawkes.)

It would seem that this patient habitually ingested, digested, and absorbed carbonaceous material in excess of his necessities for energy-production. So long as the excess was anabolized and stored extra-vascularly as fat, he remained in good health. But there was a limit to his capacity for fat-formation; and after this limit was passed, hyperpyraemia arose and led under favouring conditions to rheumatism. The favouring conditions were possibly always present more or less; but they were presumably impotent to cause rheumatism, except in partnership with hyperpyraemia.

¹ 'Self-poisoning in Heart Disease,' *Lancet*, March 21, 1896.

§ 666. RECURRENT FEBRICULA.—We have seen that in childhood some of the paroxysmal neuroses may be associated with considerable pyrexia. This applies especially to migraine, and to migrainous and bilious attacks (§ 258); and I have argued that many such cases have been included under the head of recurrent febrile gastric catarrh (§ 76). But sometimes both the headache and the symptoms of gastric catarrh are inconspicuous; and then we have simply a recurrent ephemeral fever.

Such occur commonly in childhood as an almost immediate result of excessive eating—invariably, at this period of life, excessive carbonaceous (particularly carbohydrate) eating; or they may occur at more or less regular intervals from accumulation, the result of a carbonaceous intake which habitually exceeds the physiological acarbonizing capacities. The pyrexia is commonly regarded as symptomatic of gastric or gastro-intestinal irritation or catarrh, and often, no doubt, correctly. This view, however, is not always taken. Fothergill says:¹—
‘Unless a portion of the inordinate meal be got rid of by vomiting, or by purging, it is by oxidation that it must be removed. All are familiar with the very sharp pyrexia, the sudden and marked rise of body temperature which accompanies acute indigestion.’

But careful observation shows that, in some cases, no true dyspeptic symptom *precedes* the rise of temperature; and then it is open for us to regard the succeeding gastric or gastro-intestinal disorder as a concomitant, rather than as a cause, of the pyrexia. In other words, we may ascribe the pyrexial process to the irruption into the blood-stream of carbonaceous matter beyond the amount which can be dealt with in a physiological manner, and regard it as a conservative pathological measure, adapted to promote acarbonization. In accord with this, it is my own experience that these attacks of recurrent febriculae are very liable to occur in children whose digestive power is strong, and in whom a surfeit of food does not lead to dyspepsia.

But recurrent febriculae are by no means rare in adults, although these present considerable diversity in their clinical manifestations: the following is a fairly typical case:—

A clergyman, aged 24, left Scotland, where he had always enjoyed excellent health, for Queensland. Six months after his arrival, he

¹ *Indigestion and Biliousness*, 1881, p. 169.

suffered from a feverish attack lasting a week. Similar attacks recurred, at first at monthly, later at shorter, intervals : during the last six months, he has suffered every alternate week. The attacks commenced with irritability and depression on first waking in the morning. His tongue became coated : there was constipation and disinclination for food, which, if taken, caused weight and discomfort, and seemed not to undergo digestion and absorption. He slept well at night and was drowsy through the day : his temperature rarely exceeded 101° F. Dr. Hawkes, who sent me the case, informed me that during the attack the arterial tension was raised and the liver somewhat enlarged, both these signs disappearing thereafter. On the occasion on which I saw this case, an attack was just commencing. I then found some difficulty in obliterating the radial pulse : the liver projected about two fingers' breadth below the costal margin ; and there was marked splashing in the stomach, although he had had neither food nor drink for six hours. The attacks ceased on a rather strict restriction of carbonaceous food, together with a considerable increase of exercise.

Haig¹ refers to a similar case.

A patient of mine, aged 40, a resident of tropical Queensland, has suffered on more than one occasion from the following series of hyperpyraemic manifestations :—paroxysmal asthma, angina pectoris, sciatica, and recurrent pyrexia. By the time he has reached the pyrexial stage, he is extremely emaciated. He then goes for a change to New Zealand or the Blue Mountains in New South Wales. In either place, he quickly convalesces and gains in weight with astonishing rapidity. In his case, there can be no doubt that prolonged heat is the main cause of hyperpyraemia and cold weather the most effectual acarbonizing agent.

§ 667. SOME ERYSIPELATOID AFFECTIONS.—Erysipelas has been shown to depend upon a specific microbe ; but certain inflammatory conditions of the skin of the face, indistinguishable clinically from, if not identical pathologically with, facial erysipelas, have been observed in some cases to recur with an approach to regular periodicity. Anstie² refers to several cases in which the cutaneous inflammation complicated and relieved facial neuralgia. In the first case he saw (a woman aged 32), ‘ nothing could be more startling than the rapidity with which an irregular patch of skin, including half of one cheek, the side

¹ *Uric Acid in Disease*, 1897, p. 439.

² *Neuralgia and its Counterfeits*, 1871, p. 98.

of the nose, and a large part of the forehead and scalp on the same side, became converted into the dense, fiery red, brawny tissue, with minute vesicles scattered over its surface, which looks so characteristic of erysipelas: this commenced immediately on the subsidence of severe neuralgic pain.' He adds: '¹—'Extensive enquiries convinced me that the tendency to erysipelatous complication of *facial* neuralgia is exceedingly common. Eulenburg expressly confirms my original statement to this effect and extends it to all neuralgias.' Elsewhere, Anstie argues that facial neuralgia may be a modification of migraine, an affection we have ascribed to hyperpyraemia. The same author also refers to a case² (quoted in § 505) in which old-standing 'spasmodic' asthma became complicated with facial neuralgia and recurrent erysipelas, evolving finally into angina pectoris. Asthma and angina pectoris, we have seen, may depend upon hyperpyraemia; and if the facial neuralgia in this case depended on hyperpyraemia, then there can be little doubt of the hyperpyraemic origin of the facial erysipelas.

George Keith³ refers to the case of an elderly lady. 'She was a robust healthy woman with a good stomach, and she took advantage of it. About once a year, she had a severe attack of erysipelas of the head, which cleared her out for a time. One year the erysipelas did not come on, and instead of it she had an attack of acute mania.' It is unnecessary to repeat that over-eating is the most conspicuous factor of hyperpyraemia; and later we shall see reasons to believe that, in some cases, acute mania is a manifestation of hyperpyraemia, if not a conservative acarbonizing process (§ 799 *et seq.*).

Finally, Fothergill⁴ points out that Scudamore saw erysipelas 'represent, or come instead of, the gouty fit'; and George M. Gould states⁵ that Wagner, who, we have seen, suffered throughout his life from many of the manifestations of hyperpyraemia or relative hyperpyraemia (compare § 545 *et seq.*), was for many years 'bothered by ever-recurrent attacks of erysipelas.'

¹ *Neuralgia and its Counterfeits*, p. 99.

Ib. p. 69.

² *Plea for a Simpler Life*, 1897, pp. 71, 72.

⁴ *Gout in its Protean Aspects*, 1883, p. 129.

⁵ 'The Rôle of Eye-strain in Civilization,' George M. Gould, *Brit. Med. Journal* September 26, 1903, p. 758.

RECURRENT 'IDIOPATHIC' HAEMORRHAGE

§ 668. Haemorrhage, we have seen, necessarily tends to acarbonize the blood, at least as an immediate result (§ 154) : this it does through direct loss of material. We have regarded menstruation as a periodic acarbonizing process, physiological or semi-physiological in nature, and dependent upon an inter-menstrual accumulation of carbonaceous material tending to hyperpyraemia. But haemorrhagic acarbonization may take place in circumstances which cannot be regarded as physiological. Such may be incidental—that is to say, hyperpyraemia may not enter into their causation—as in traumatic haemorrhage, haemorrhage from ulceration, etc. But there can be no doubt that many cases of so-called 'idiopathic' haemorrhage depend upon hyperpyraemia, or upon a tendency thereto ; and such must be regarded as conservative processes adapted to promote acarbonization of the blood.

§ 669. VICARIOUS MENSTRUATION.—This view of the meaning of some cases of haemorrhage fully explains the occurrence of vicarious menstruation. If normal menstruation is a response to hyperpyraemia, or a tendency thereto, the same must be true of vicarious menstruation. In the presence of local conditions, tending to prevent or render inadequate haemorrhage from the uterus, the female organism is apt to take advantage of alternative outlets. We may fairly imagine that the female organism finds it easier, in such cases, to continue its long-accustomed periodic haemorrhagic acarbonization, than to institute what must be more revolutionary changes, namely, the increases in the rate of katabolic and anabolic acarbonization (combustion and fat-formation), which are known to occur upon checked menstruation (§ 156), when no alternative outlet for haemorrhage exists—when, that is to say, vicarious menstruation does not take place. It is hardly necessary to add that what is true of checked menstruation or temporary loss of the uterine outlet may be true of the menopause or permanent loss of the uterine outlet, through physiological involution of the generative organs.

Haemorrhoidal haemorrhage in women before the menopause may precede or accompany, thereby to some extent replacing, menstruation. This is practically implied in the use of the French term 'supplementary,' as applied to haemorrhages

occurring at the time of menstruation. In women who suffer from non-bleeding piles, a considerable increase in tension and discomfort antecedes, and for a day or two may accompany, the menstrual flow.

After the menopause, haemorroidal haemorrhage may replace menstruation completely. Tilt says: ¹—‘Gardanne has mentioned the case of a lady in whom cessation occurred at 48: she lost every month a large quantity of blood from piles until she was 75; and suffered from evident signs of plethora until the evacuation took place. Stahl has seen similar cases, and Menville gives one in which, for ten years after cessation, haemorrhoids occurred monthly. Gendrin and B. de Boismont have likewise noticed continuous or intermittent haemorrhoidal fluxes at cessation.’

What is true of haemorrhoidal haemorrhage is true of many other haemorrhages. James Mackenzie says: ²—‘When menstruation is impending, a tendency to haemorrhage is manifested elsewhere than from the uterine vessels. Bleeding at the nose is sometimes observed occurring at regular monthly periods. I have seen a few cases of ulceration of the nasal mucous membrane, where, on the day preceding the menstrual flow, a few drops of blood would flow from the nose. Surgeons have observed that occasionally in sinuses, from which there was usually a sero-purulent discharge, this discharge becomes bloody about the menstrual period. I have at present under observation a woman with chronic phthisis, who for some years has had to rest in bed during her menstrual period, because haemorrhage from the lung frequently occurred at that time.’

Lancereaux ³ has observed the same occurrences. He calls attention to the supplementary epistaxis of menstruation; and says that at a later age haemoptysis, haemorrhoids, haematuria, or even extreme axillary perspirations, may occur instead. ‘Headache, mental confusion, vertigo, dimness of sight, and facial congestion, precede the epistaxis—symptoms not usually observed in traumatism with organic lesions.’ ⁴ The occurrence of menstrual haemoptysis may be supplemented by, and depend upon, the bronchial vaso-dilation which is the anatomical cause of menstrual asthmatic paroxysms. ‘Frank relates the case of

¹ *Change of Life*, 1882, p. 274.

² *The Study of the Pulse*, 1902, p. 74.

³ *Med. Review*, 1900, pp. 603, 604, quoting *Bull. de l' Acad. de Méd.*, August 28, 1900, p. 273.

⁴ *Ib.*

a girl who had asthma with cough and haemoptysis at every menstrual period' (*Lancereaux*).¹

The tendency to all these supplementary menstrual haemorrhages is naturally greatly increased when conditions intervene to close, or render inadequate, the uterine outlet : supplementary menstrual haemorrhages then pass into vicarious menstruation. When such recurrent losses continue, or arise, after the menopause, they must be regarded as substitutive of the revolutions of carbonaceous metabolism which, we have seen, occur normally at this period of life (§ 174 *et seq.*).

§ 670. THE MODERN TENDENCY TO DENY THE EXISTENCE OF VICARIOUS MENSTRUATION.—Macnaughton Jones² has not the least doubt as to the occurrence of vicarious menstruation. He has had several cases in which it resulted from suppressed menstruation, or came on during the commencing irregularities at the menopause. He relates the following striking case :—

One lady I attended for some years, and whenever the catamenia were suppressed for a few periods, she had violent haemoptysis, alarming to herself and friends. This quite ceased with the end of the climacteric, and she remained in perfect health for years. The haemorrhage generally lasted for two or three days. . . . Before the haemorrhage, she suffered from fulness in the head and shortness of breath. She was otherwise a robust woman and in good health.

Fagge says :³ ‘In some women epistaxis has been observed to be distinctly vicarious of the catamenia. A striking instance of this is one recorded by Obermeier.’ (Already quoted, § 465.)

Mr. E. Rumley Dawson relates a typical case of vicarious menstruation (haematemesis), of which the following is an abstract :—

A healthy and robust domestic, single, aged 29, previously regular, the menstrual periods being profuse and lasting six full days, was revaccinated on October 26, 1901, the second day of menstruation. The shock of the operation induced syncope, and the menstrual flow ceased suddenly and did not return. The succeeding six periods occurred at their proper dates, but the loss on each occasion was a mere trace. During the whole of this time she suffered in a progressively increasing degree from the symptoms of premature menopause : insomnia, flushes, vertigo with inclination to fall and

¹ *Med. Review*, 1900, pp. 603, 604, quoting *Bull. de l'Acad. de Méd.*, August 28, 1900, p. 273.

² *Diseases of Women*, 1897, p. 39.

³ *Text-book of Medicine*, 1891, vol. i. p. 1132.

severe palpitation. On April 28, 1902, she commenced to have headache : on the 29th, she had syncope and vomiting : on the 30th, vomiting, at first of food, then of blood to the amount of two pints. On the afternoon of this day, her menstrual period came on : it was profuse and normal. Thereafter, menstruation continued regularly, being normal (for her) in amount and duration : complete and rapid convalescence eventuated.

§ 671. The occurrence of vicarious menstruation, or menstrual haemorrhagic acarbonization by means of outlets other than the uterine, is to my mind such a conspicuous clinical fact, that I have been puzzled to understand why it has been so persistently denied. So far as I can see, this is to be accounted for in two ways : (1) by the modern neglect of humoral views ; and (2) by over-specialization. Over-specialization, one result of exclusive induction, tends to inordinate differentiation and extreme localization. Hence the local aspect and the local phenomena of menstruation tend to monopolize attention largely to the exclusion of the general aspect and the general phenomena.

It has been stated that menstruation is the expression of rhythmic preparations *on the part of the uterus* for pregnancy, and that consequently it is quite impossible for any other organ to take on vicariously the menstrual function. In this argument the general aspect of menstruation is ignored : the process is assumed to consist merely of preparations for pregnancy *on the part of the uterus*. This assumption is treated as a fact and used to discredit very numerous, old-standing, well-accredited and convincing, clinical observations. To me it seems that the clinical observations referred to are enough to upset any merely uterine theory of menstruation—that the fact that other organs do take on vicariously *a part* of the menstrual function is sufficient to prove that menstruation is not a mere expression of rhythmic preparations on the part of *the uterus* for pregnancy ; and this, even without the fact that many of the phenomena of menstruation, such as increased vascular tension, are most distinctly general in character.

It is further stated that in those cases in which the occurrence of haemorrhage has been correctly stated, enquiry has usually shown that there was some definite pathological condition to account for it. Thus the recurrent haemorrhage

took the form of haemoptysis in phthisis, of haematemesis in gastric ulcer, melaena in haemorrhoids, haemorrhage from the nipple in breast carcinoma, etc. This may be freely admitted, but it is beside the mark as an argument against the theory of vicarious menstruation here advocated. The pathological conditions referred to may be regarded as incidental factors determining the localization of the vicarious outlet for haemorrhage, in exactly the same sense as the physiological condition of the uterine mucosa in normal menstruation largely determines the localization of the normal uterine outlet.

The conservative influence of both uterine and vicarious menstruation was fully recognized by Hippocrates, who observed that (1) ‘haemoptysis¹ in a woman is removed by an eruption of the menses’; and (2) ‘in a woman,² when there is a stoppage of the menses, a discharge of blood from the nose is good.’ And Galen deduced therefrom the propriety of letting blood from other parts of the body in such a case—a practice which is still largely advocated.

§ 672. CONSERVATIVE HAEMORRHAGIC ACARBONIZATION NOT SUBSTITUTIVE OF THE MENSTRUAL PROCESS.—We have no excuse for denying that haemorrhage may be a response to carbonaceous accumulations, other than that which is incited by the anabolic demands of the mature female. Haemorrhagic acarbonization may depend upon, and disperse, carbonaceous accumulations arising in any way. So we have cases in which more or less regularly recurrent haemorrhages of various kinds occur in the male sex. Such may replace any of the manifestations of hyperpyraemia, whether acarbonizing process, such as some of the paroxysmal neuroses and gout, or other, such as some neuralgias, persistent high blood-pressure, chronic catarrhs, and certain forms of mental aberration.

The conservative influence of recurrent haemorrhage is, in very many cases, a conspicuous clinical fact. Sir Robert Peel, on hearing the news of his defeat, remarked:—‘I am glad it is over. No man can be Prime Minister of England for five years without undergoing a terrible strain. If my nose had not bled every night I could not have stood it’ (*St. James’s Gazette*). Fagge says:³—‘Some of those who suffer from recurrent or “habitual” epistaxis . . . are plethoric, with

¹ *Genuine Works of Hippocrates*, Adams, section v. Aph. 32. ² Aph. 33.

³ *Text-book of Medicine*, Fagge (1891), vol. i. p. 1132.

flushed cheeks and injected conjunctivae ; and they may experience from time to time sensations of oppression and giddiness, noises in the ears, throbbing in the head, fulness and heat in the nose, which they recognize as indications of the approach of an attack of haemorrhage and which are at once relieved when it occurs.' Rendu ('Semaine Méd.' June 1881) says that 'epistaxis may occur in young persons who become later subjects of piles or rheumatism.'¹ And Sydney Phillips relates ten cases of recurrent epistaxis in children, in none of which could be discovered any cause for the bleeding, other than the rheumatic diathesis.² 'He also refers to other cases in which the epistaxis either came on with an attack of acute rheumatism, alternated with attacks of arthritis, was preceded by them, or occurred in connexion with chorea.'³ Epistaxis has been observed to have identical relations with gout. Harry Campbell says :⁴—'It is certain . . . that plethora is frequently accompanied by distinct nervous symptoms which disappear after bleeding, foremost among these being giddiness, noises in the ears, and confusion of thought, all of which are very common in cases of sudden cessation of menstruation. They may also occur in plethoric men.' He recalls two instances. The first was that of a florid, full-blooded man, who, for many years, had suffered a monthly loss of blood per rectum : just before the wonted period, he would experience giddiness, confusion of thought, and other nervous symptoms, all of which would be removed by a copious flow. The second was that of a man of like habit who for some time had been experiencing similar symptoms. 'One night after a highly indigestible supper, he was attacked with great pain in the stomach and violent vomiting which led to a profuse haematemesis, after which his unpleasant symptoms almost entirely disappeared.' The author quoted was induced to cite these cases because he had heard good authorities maintain that a loss of blood is always to be deprecated.

The following case, related by Lancereaux, leaves little room for doubt as to the causative influence of hyperpyraemia : 'A man, aged 50, who ate immoderately, was extremely fat,

¹ 'Epistaxis in Children from Rheumatism,' Sydney Phillips, *Med. Review*, May 1902.

² *Ib.*

³ *Ib.*

⁴ *Flushing and Morbid Blushing*, H. Campbell, 1890, p. 212.

and had never coughed, had sudden haemoptysis during the night after a heavy dinner. The heart and lungs were normal. Quietude and restricted diet brought about recovery in a few days, and no further haemoptysis afterwards occurred.'¹

§ 673. We have seen recurrent migraine replaced over considerable periods by recurrent epistaxis (§ 330) : and it is difficult to avoid concluding, in such cases, that both affections own a common cause, as well as a common effect. I have traced the origin of haemorrhoids from a state of high carbon contents of the general blood-stream or hyperpyraemia, backwards, in the course of the circulation, to glycogenic distension of the liver, and thence to mechanical congestion of the portal venous system ; and I have argued that the ultimately eventuating haemorrhoidal haemorrhage is adapted to promote acarbonization of the general blood-stream, as well as to relieve the congestion of the portal venous system (§ 91).

Haemorrhoidal haemorrhage, together with the haemorrhoidal distension upon which it depends and which it relieves, tends in some cases to be regularly recurrent even in men. Both conditions, as already stated, may be markedly relieved by restriction of the carbonaceous—especially the carbohydrate—intake : they may be relieved also by physical exercise, by pyrexia, and probably by anything which tends to reduce the carbon contents of the blood and the associated glycogenic distension of the liver.

In the following case (an example of many of which I have notes), the connexion between headache, glycogenic distension of the liver, and haemorrhoidal haemorrhage, and the dependence of all three upon hyperpyraemia, are clearly inferable :—

A gentleman of 40, taking little or no exercise, with a good appetite and digestion and living rather well, has suffered for the last twelve months from recurrent headache as often as once a week or once a fortnight. During the attack, there is some impairment of appetite, but no vomiting or other digestive symptom : in one attack, I found the liver projecting a little below the costal margin and a little tender on pressure. When the bowels act during a headache, there is always a little haemorrhage from piles, he thinks not more than one ounce in all : when this happens, he obtains almost immediate relief from all his symptoms : the attack, which is liable

¹ Quoted in *Med. Review*, 1900, pp. 603, 604, from *Bull. de l'Acad. de Méd.*, August 28, 1900, p. 273.

to last twenty-four hours, is in fact aborted. His piles bleed on no other occasion. A moderate restriction of his carbonaceous intake, with an increase of exercise, completely removed all tendency to headache and haemorrhage.

The view that haemorrhoidal haemorrhage is conservative seems to have slipped into the background of recent years. This was not always so. The following paragraph from Troussseau shows that, in his day, the relief afforded by such haemorrhages was regarded as hardly open to question. 'Every¹ physician knows that the supplementary functions, which are constituted by habitual fluxes, serve useful purposes, and can only be interfered with when careful management is adopted.' We have already seen, on the authority of Garrod, that the sudden suppression of an habitual haemorrhoidal flux not infrequently tends to cause attacks of gout; and Fothergill² says that 'the patient looks forward with delight rather than apprehension to some bleeding from the bowel.' In the following case the conservative influence of recurrent haemorrhoidal haemorrhage was manifest:—

A stout man of 50, given to hearty eating and drinking, developed piles. These soon commenced to bleed at fairly regular intervals, whereupon his general health improved for a time. Later, however, the bleeding became excessive, and in consequence his piles were excised. A few months later, he was attacked with severe haemoptysis, which recurred on several occasions. Change of air, abstinence from alcohol, and moderation in food, resulted in recovery.

§ 674. Many obscure cases of epistaxis, haemoptysis, haematemesis, melaena, etc., may be fully explained by hyperpyrexia. In the following case, the success of surgical haemostasis resulted in some of the other well-known manifestations of hyperpyrexia, thereby placing the fundamental factor and the conservative influence of the haemorrhage apparently beyond question:—A boy suffered frequently from bleeding from the left nostril. 'The galvanic cautery was applied and the bleeding took place from the right nostril. After further use of the cautery, epistaxis ceased, but violent headaches, vertigo, and occasional loss of consciousness,

¹ *Clinical Medicine*, New Syd. Soc., vol. iv. p. 399.

² *Gout in its Protean Aspects*, J. M. Fothergill, 1883, p. 117.

occurred. Considerable amelioration, however, followed change of scene and the administration of the bromide' (*Lancereaux*).¹

All the above varieties of recurrent 'idiopathic' haemorrhage are mentioned by Fothergill² as common incidents in the 'gouty' state—a condition here ascribed to hyperpyraemia. So also is menorrhagia. 'Menorrhagia, often accompanied by much suffering, is not uncommon in females who, later on in life, suffer from unmistakable gout' (Fothergill).³ Sydenham termed the responsible condition 'luxury of the blood.'

§ 675. George Keith⁴ refers to a case of severe haematuria, which he diagnosed as depending on excess of food, and which was completely relieved by the enjoinder of a spare diet. B. London says:⁵—'In most of these renal haemorrhages (known as gouty haematuria, or congestive hyperaemia of the kidneys), there is a total absence of the signs of nephrolithiasis or of contracted granular kidney. The onset of the haemorrhage is sudden, without any apparent cause, and recurs from time to time in the same manner.' Poljakoff ('Deutsche Med. Woch.' November 2, p. 721)⁶ relates the following fully illustrative case, in which the hyperpyraemic factor is confirmed by the pre-existence of other vaso-motor affections:—'A woman, aged 25, had suffered, ever since 12, from frequent and severe attacks of megrim, and other vaso-motor disturbances, such as the appearance on excitement of red patches over the face and upper part of the body. She had mitral regurgitation but perfect compensation. For five years she had neuralgia in different nerves (left supraorbital, left brachial, and several left intercostal nerves), and, during the same period, she frequently suffered from pain over the left kidney. The urine was at first normal, but for one and a half years there had been attacks of transient haematuria, which lasted for one to three days, and disappeared with rest in bed, a milk diet, and ergot. During the attack, the urine contained numerous red corpuscles and a few leucocytes. The writer had attended the patient for years and could exclude haemophilia with certainty. As causes, new growth, renal tuberculosis, and

¹ *Med. Review*, 1900, pp. 603, 604, quoting *Bull. de l'Acad. de Méd.*, August 28, 1900, p. 273.

² *Gout in its Protean Aspects*, 1883, p. 155.

³ *Ib.* p. 166.

⁴ *Plea for a Simpler Life*, George Keith, 1897, pp. 64, 65, 66.

⁵ 'Treatment of Gout at Carlsbad,' B. London, *Practitioner*, August 1903, p. 176.

⁶ Quoted in the *Medical Review*.

heart disease, could be excluded. The blood probably came from the left kidney, as there were pain and tenderness over it during an attack. . . . A week after the last attack of haematuria, there was profuse intestinal haemorrhage, which lasted in spite of treatment for nearly three weeks. Nothing could be found to account for it, and, like the haematuria, it was probably of angio-neurotic origin. It is known that haemorrhage from other organs, such as the stomach and lungs, may have the same cause. The writer has seen a powerfully built man, who suffered periodically from recurring profuse haemoptysis, although his heart and lungs were healthy.'

But efficiently acarbonizing haematuria may be determined by an obvious local factor. Dr. E. G. Gilbert¹ describes the case of a man of 57 who 'was suddenly seized one day when cycling with severe substernal pain. . . . From that time, seven and a half years ago, until one month ago, that pain had returned upon exertion, but with varying degrees of readiness, and never except upon exertion or occasionally upon excitement. At first it was often attended by extreme irregularity and fluttering of the pulse, but this subsequently ceased. . . . A small dose of nitro-glycerine had a magical effect in preventing the pain. . . . He was liable before to an occasional attack of lumbago, to occasional pharyngeal catarrh with muscular rheumatism of the pharyngeal muscles, and to occasional slight duodenal catarrh, of each of which he had had three or four attacks since. . . . About five years ago I discovered he had a villous growth in the bladder. At the beginning of January last considerable haematuria came on, and lasted three weeks (being finally checked by an injection of adrenalin chloride). . . . When he got up and got about again, I was surprised and delighted to find that the tendency to cardiac pain, which had before he took to bed been very troublesome, had disappeared so far as any moderate exertion was concerned, say, walking three miles an hour on the level. A week in bed on previous occasions had had no good effect.'

§ 676. MECHANISM AND IMMEDIATE MEDICAL TREATMENT OF 'IDIOPATHIC' AND OTHER HAEMORRHAGES.—Haemorrhoidal haemorrhage is a venous haemorrhage: the anteceding vascular distension or congestion is mechanical, and due to the block introduced into the portal circulation by glycogenic

¹ *Brit. Med. Journal*, March 12, 1904, p. 640.

distension of the liver. But many internal haemorrhages are capillary; and the antecedent vascular distension or congestion is active, and due to dilation of the arterioles in the affected area. Such vascular distension will be greatly intensified, if, as so commonly happens, there is concurrently vasoconstriction in other areas. Widespread vaso-constriction, combined with localized vaso-dilation, constitutes, as already argued, the essential mechanism of the vascular distension in physiological and vicarious menstruation, in the epistaxis and other haemorrhages of migraine and hyperaemic headaches generally, in the haemoptysis of asthma and the haematemesis of gastralgia. And there can be hardly a doubt that such is the mechanism of 'malarial epistaxis.' Of this variety, Fagge says:¹—'In cases of ague not only is it sometimes associated with the ordinary paroxysm of the disease, but it is said to have occurred periodically as the sole symptom and effect of malarial poisoning, until stopped by the administration of quinine.' In a case of epistaxis in a gouty patient, the dilated artery, which determined the bleeding, was actually palpated by James Mackenzie. Of this case, the author says:² 'During my attendance on him at this time I made a curious observation. The bleeding came on in irregular attacks, there being sometimes a couple of days between the two. While compressing the nose during an attack of bleeding from the right nostril, I felt an artery beating strongly by the side of the nose. By exerting pressure with the finger upon the artery, the bleeding invariably ceased. During the intervals between the attacks, the artery could not be felt.'

§ 677. An essential factor in all cases of haemorrhage is the existence of a certain vascular distension, or local blood-pressure, in the bleeding area; and the primary indication for treatment will be the reduction of this vascular distension or local blood-pressure. This may be achieved (1) by vasoconstriction of the arterioles supplying the bleeding area; or (2) by vaso-dilation of other areas (compare § 357).

1. In cases where the bleeding area is accessible, the supplying arterioles may be constricted by local applications: in this case, the tone of the vascular system generally will not be materially increased. Examples are, the use of a spray of

¹ *Text-book of Medicine*, Fagge, 1891, vol. i. p. 1132.

² *The Study of the Pulse*, 1902, p. 74.

adrenalin solution (1-1000) in epistaxis, and the administration of ice pills or adrenalin by the mouth in haematemesis.

But often the bleeding area is inaccessible. Then, in order to attain vaso-constriction of the arterioles supplying the bleeding area, it is necessary to promote vaso-constriction of the arterial system generally. Until recently, ergot was the remedy mainly relied upon for this purpose; but, although I used it consistently for many years, I could never assure myself that it was of any real value, except of course in uterine haemorrhage in which its action is otherwise explicable. Now, however, that far more powerful vaso-constrictor adrenalin has taken the place of ergot; and there can be no doubt that its general, as well as its local, action has been successfully utilized as a haemostatic.

There are, however, certain disadvantages connected with the *general* action of adrenalin which I am not yet sure are purely hypothetical. Other things remaining unchanged, general vaso-constriction raises the blood-pressure, and this would tend to defeat the end in view, namely, the reduction of local blood-pressure. But other things do not necessarily remain unchanged: the rising blood-pressure which follows general vaso-constriction may be largely, if not fully, anticipated by vagus inhibition of the heart-beat; and this doubtless explains the success of adrenalin in checking haemorrhage when given by the mouth or hypodermically. It cannot, however, be maintained that compensation by cardiac inhibition for any widespread vaso-constriction is entirely free from danger. Such, there seems little doubt, is the mechanism of the cerebral anaemia responsible for many cases of syncope: such, I am myself convinced, is the mechanism of some cases of major and minor epilepsy; and it has been shown by Pugh¹ that the administration of adrenalin in epilepsy is capable of increasing the number of attacks. It seems not inconceivable, therefore, that the use of the drug might in certain predisposed cases initiate a recurrent epilepsy.

§ 678. 2. The second means, by which we may reduce vascular distension or local blood-pressure in the bleeding area, is by promoting arterial dilation in other areas. In a few cases, this may be achieved within the distribution of a single arterial trunk, without reducing the tone of the arterial system

¹ *Brain*, 1902, p. 501.

generally. W. Essex Wynter says:¹ ‘Perhaps as simple and effective a method of arresting minor forms of epistaxis as any is merely “champing” the jaws, when the blood flow of the internal maxillary artery is diverted to the muscles of mastication, and the smaller terminal vessels in the nose are starved and cease to bleed.’ But, as a rule, we shall be forced to depend upon measures which promote widespread or general vaso-dilation. By means of heat to the surface, as in general hot bathing, water or vapour, we may promote vaso-dilation of the cutaneous area: the result is a fall of blood-pressure (Leonard Hill);² and general hot bathing will reduce many forms of pathological haemorrhage, just as it reduces the physiological haemorrhage of menstruation (§ 462). But even the promotion of localized cutaneous vaso-dilation, preferably perhaps at a distance from the bleeding area, may act as an efficient haemostatic: immersion of the feet and legs in hot water is capable of arresting epistaxis in many cases. We have already seen that this expedient gives relief from headache (§ 361); and the mechanism of the relief in both cases is doubtless the same, namely, the reduction of vascular distension of the affected area.

§ 679. But probably the most generally useful agent in checking haemorrhage through general vaso-dilation and consequent fall of blood-pressure, general and local, is amyl nitrite: it is easily applied, capable of immediate use, and its action is practically instantaneous. Its efficiency is readily demonstrated. The following case was communicated to me by Dr. Hawkes:—

A man of 36, who suffers from mitral insufficiency, is often attacked, on catching cold, with haemoptysis. This, in all probability, is a response to cutaneous vaso-constriction. The bleeding had never ceased under two days: usually, it had persisted for from two to four days: on one occasion, it had persisted for ten days. On the last occasion, haemoptysis began at midnight. There was marked coldness of the hands and feet, which was not due to anxiety. The inhalation of one capsule of amyl nitrite instantly relieved the vascular spasm of the extremities, and, although the expectoration continued blood-stained until the following day, it was quite clear that the bleeding had been instantaneously checked.

¹ ‘Simple Expedients in Physical Therapeutics,’ W. Essex Wynter, *Lancet*, January 2, 1904, p. 13.

² *Text-book of Physiology*, E. A. Schäfer, 1900, vol. ii. p. 80.

The rationale of the result is simple. Amyl nitrite, by inducing widespread vaso-dilation, reduces the resistance in the aortic outflow ; and, as Schäfer points out, the blood-pressure in the pulmonary circulation may be reduced passively ‘by a fall of pressure in the left auricle due to diminished resistance in the aortic outflow.’¹

§ 680. But the treatment of internal haemorrhage by the induction of general vaso-dilation will apply not alone to cases in which there is exaggerated peripheral vaso-constriction. The normal condition of the systemic arterioles is one of tone, and the induction for a time of a subtonic condition in widespread areas will materially reduce vascular distension in the bleeding area, and thereby increase the probability of haemostasis. This consideration suggested the employment of amyl nitrite in the haemoptysis of phthisis. The following is a short account of the early cases in which the treatment was tried :—

John S——, aged 31, phthisical patient in the Diamantina Hospital, with consolidation and softening at the left apex, had haemoptysis at 4.30 P.M. One capsule of amyl nitrite was immediately given by inhalation, whereupon the bleeding ceased instantaneously. At 6.50 there was a slight recurrence, and nitro-glycerine $m\frac{1}{10}$ was ordered to be given every two hours. Rather profuse haemoptysis recurred at 12.40 on the following morning, but was again stopped instantaneously by amyl nitrite inhalation. Since then, there has been no bleeding.

In this case, there can be little doubt that the bleeding ceased *propter*, and not merely *post, hoc*. On both occasions on which the inhalation was given, the patient was bringing up mouthfuls of blood at regular intervals of about two minutes : and, on both occasions, the mouthful preceding the inhalation was the last of the series.

Edward C——, aged 34, phthisical patient in the Diamantina Hospital, with consolidation, softening, and slight excavation of the upper part of both lungs, had had twelve attacks of haemoptysis in nine years. Each attack had begun insidiously and steadily increased in severity. On no occasion had he ever had a slight attack of haemoptysis which had passed off, or been overcome, without laying him up for ten days or a fortnight ; and most attacks had constituted serious intercurrent illnesses, which had left him conspicuously worse than at their onset, and from which he did not recover for some weeks.

¹ *Text-book of Physiology*, E. A. Schäfer, 1900, vol. ii. p. 150.

On January 16, 1904, he began to cough up a little blood unmixed with his ordinary sputa. He was immediately ordered to bed, all food stopped, and a 5 minim capsule of amyl nitrite administered. The haemoptysis stopped immediately, although streaks of blood permeated his sputa for a few days. During these days, a capsule remained on his locker in readiness, and he was directed to use it at once should the haemoptysis return : it was not required, however.

Catherine B——, aged 26 : single : phthisical patient in Diamantina Hospital : excavation both apices. Had suffered from many attacks of haemoptysis, some of which were very profuse, and most of which were succeeded by exaggerated temperature and indications of pneumonia : she was especially liable to bleeding from the lung when menstruation was impending. On February 27, 1904, when her menstrual period was seven days overdue, she had haemoptysis at 5.25 A.M. to the extent of two and a half ounces : this ceased immediately on inhalation of one capsule of amyl nitrite. At 8 A.M., the bleeding recurred and she lost eleven ounces : on this occasion, amyl nitrite, though followed by an immediate retardation of the bleeding, did not succeed in completely checking it until ten minutes had elapsed. She was then ordered nitro-glycerine $m\frac{1}{10}$ every two hours. At 11 A.M., she had two ounces of haemoptysis, which ceased spontaneously. On February 29, she had two ounces of haemoptysis, which ceased under amyl nitrite in three minutes. On March 19, at 9 A.M., she had one ounce of haemoptysis, which ceased in three minutes after an amyl nitrite capsule. She was then put on erythrol tetranitrate at gradually increasing intervals. On none of the above occasions was there any subsequent inflammatory reaction or extra rise of temperature.

M. B——, phthisical patient in the Jubilee Sanatorium, Dalby, Queensland : cavity in right apex. On December 6, 1903, haemoptysis commenced. Over five ounces of blood had been lost when one capsule of amyl nitrite was administered by inhalation. The haemorrhage ceased instantaneously and completely. On January 30, 1904, there had been no recurrence of the haemoptysis. Dr. Andrew Stewart, visiting medical officer of the Sanatorium, who reports this case, points out that there was no subsequent congestion, nor rise of temperature, such as usually occurs after haemoptysis as severe as occurred in this instance.

Shortly after, two other cases of haemoptysis occurred in the Jubilee Sanatorium. The first of these had two attacks, both somewhat profuse, separated by an interval of half an hour. Amyl nitrite inhalation stopped the bleeding in both attacks instantaneously. The second case had one attack which ceased immediately on inhalation of the drug. In neither

of these cases was there any subsequent additional rise of temperature. All haemorrhagic cases in the institution are now provided with a capsule of amyl nitrite which they are directed to use immediately on the appearance of haemorrhage.

Dr. Wield of Brisbane reports the instantaneous cessation under amyl nitrite of haemoptysis which he had been treating ineffectually for some time.

Thus of thirteen attacks of haemoptysis (twelve phthisical, one cardiac) treated by amyl nitrite inhalation, all save one ceased within three minutes, the one referred to being delayed for ten minutes.

§ 681. Manifestly in phthisical haemoptysis, there is in operation one of the most highly vicious circles in pathology—a circle which is largely responsible for the profuseness and prolongation of the haemorrhage. The intra-pulmonary irritation of the effused blood causes cough: each act of coughing, like any other sudden exertion, causes rise of blood-pressure: each rise of blood-pressure is apt to cause fresh haemorrhage; and so on over again, the circle continuing to revolve in many cases until the loss of blood has been sufficient to reduce the blood-pressure materially and thus terminate the haemorrhage. This natural cure of haemoptysis was, at one period in the history of medicine, imitated by physicians who resorted to venesection in this emergency—a somewhat expensive, but by no means irrational, imitation. The treatment by amyl nitrite is another imitation, less complete, but much more economical, than venesection. The vicious circle is broken through at the same point and by similar means, namely, by reduction of localized blood-pressure through reduction of general blood-pressure. But the blood is saved instead of being lost: consequently, the procedure may be repeated as often as may be necessary.

The point at which the vicious circle is broken through is of the greatest importance. Too often, I am sure, I have yielded in the past to the temptation to smother cough by a hypodermic injection of morphia. The resulting cessation of cough undoubtedly tends to the cessation of the haemorrhage, but in proportion to the cessation of cough, so is the tendency to retention in the lung of blood already effused; and retained blood decomposes, and not rarely induces septic pneumonia, high temperature, and prolonged exhausting illness which may end fatally. This has been the history of so many cases, which

seemed under open-air treatment on the road to recovery, that I had come to regard haemoptysis as a grave misfortune. But if amyl nitrite proves efficient as a haemostatic, the haemoptysis of phthisis will be largely freed from its subsequent, as well as its immediate, dangers, for *the action of the drug is a safeguard against retention.* It is the influx of blood to the ulcerated lung tissue, not the efflux of blood from the air-passages, which is checked, and the uninterrupted continuance of cough assures the rapid evacuation of blood already effused. In none of the cases detailed was there, so far as could be ascertained, any retention of blood: in none of them certainly was there the least subsequent additional rise of temperature.

Amyl nitrite should prove efficacious in many forms of haemorrhage in which the bleeding area is inaccessible to local treatment. In the haematemesis of gastric ulcer, it might perhaps be desirable to add the local vaso-constrictive effect of adrenalin to the general vaso-dilative effect of the nitrite. In the intestinal haemorrhage of typhoid, amyl nitrite would probably prove less useful, since the action of the drug is fugacious and it is difficult to fix the exact time at which the haemorrhage is occurring. Finally, unless the cerebral circulation is subject to rules which differ fundamentally from those of the systemic and pulmonary circulations, I cannot see why inhalation of amyl nitrite should not prove of value at the commencement of cerebral haemorrhage.

SUMMARY

§ 682. In this chapter, I have argued that some catarrhs and other pyrexial and sub-pyrexial affections, together with many so-called 'idiopathic' haemorrhages, depend upon hyperpyraemia, or a tendency thereto, and constitute pathological acarbonizing processes. Though they thus unite in owning one common factor and one common effect, yet each of these heterogeneous affections doubtless owns factors peculiar to itself and effects peculiar to itself. Consequently, it is to be expected that their further pathological evolution will diverge accordingly.

CHAPTER XVII

§§ 683-710

Continuous pathological acarbonization, possibly depending on hyperpyraemia, or on some of the factors, or results, of hyperpyraemia—Glycosuria, including some forms of diabetes: food, external temperature and physical exercise: sex and age: obesity: pyrexia: Bouchard's statistics: theory of diabetes—Speculations as to the predisposition to consumption: food: exercise, air, and temperature: amenorrhoeal hyperpyraemia: pregnancy: fat-formation: pyrexia, including gout: paroxysmal neuroses: treatment—Speculations as to the predisposition to cancer: physiological associations of cancer: pathological associations of cancer: therapeutic associations of cancer: a chemical, bio-chemical, or metabolic hypothesis for the etiology of cancer: the 'tumour germ' theory of cancer—Summary.

GLYCOSURIA, INCLUDING SOME FORMS OF DIABETES

§ 683. We have agreed, upon what seems moderately good evidence, that glycosuria may play the part of an acarbonizing process; but this hardly helps us to elucidate the pathology of the affection. There are, however, many considerations tending to the belief that glycosuria, if not directly dependent upon, owns many factors in common with, hyperpyraemia.

§ 684. FOOD, EXTERNAL TEMPERATURE, AND PHYSICAL EXERCISE.—Saundby¹ has investigated the influence of these conditions in the causation of diabetes. He finds that the disease is very frequent in Ceylon and is most prevalent amongst the well-to-do natives. In that country, it is regarded as a disgrace and as a punishment for ill-gotten wealth. Hence it is commonly concealed, and the official returns are valueless as an index of its frequency. One physician sees in his private practice an average of two fresh cases a week, and finds temporary glycosuria very common. 'He² is thoroughly of opinion that over-indulgence in starchy foods and sugar, combined with sedentary habits . . . are important factors in its causation.' Surgeon-General Cornish³

¹ *Renal and Urinary Diseases*, 1896, p. 237 *et seq.*

² *Ib.* p. 239.

³ *Ib.*

(quoted by Saundby) says:—‘The frequency of diabetes amongst the better classes, *i.e.* those who do not engage in manual labour, is a matter of common notoriety amongst Indian practitioners. . . . My own observations seemed to show that the educated and learned classes . . . suffered in the greatest proportion, and that it was rare to find men of these classes lasting to a robust old age.’ Norman Chevers refers to the frequency of diabetes among rich elderly natives of Calcutta, many of whom are fat and indolent and immoderately fond of sweetmeats. ‘The editor¹ of the “Indian Medical Gazette,” writing in 1871, stated that among the upper and middle classes of natives in Calcutta, almost every family had lost one or more of its members from this disease.’

Fagge² made use of the supposed especial frequency of diabetes in Scotland, a country notoriously free from gout, as an argument against the relation between these two diseases. But such a relative preponderance would, from our standpoint, favour the relationship. Both diseases may have many factors in common: they have at least one well-marked conservative effect in common, namely, acarbonization of the blood. Hence they will rarely be called for in the one subject, still more rarely simultaneously in the one subject: their very relationship implies antagonism. Conformably, Williamson³ points out that ‘in the cases in which the two diseases are associated, the diabetes is usually of a mild form, the general condition is good, and the prognosis favourable.’ It may be added, on the authority of Garrod, that in these associated cases the gouty manifestations also are modified. The extreme frequency of diabetes in India must be a factor—it is possibly one of the most important factors—in the rarity of gout in that country. For, as pointed out by Surgeon-Lieutenant-Colonel Alexander Crombie,⁴ diabetes is very common in the classes corresponding to those who suffer from gout in England—in those, that is, who live well, who are of sedentary occupation, and who are engaged in mental labour. ‘Diabetes is the gout of the native judicial department.’⁵

§ 685. SEX AND AGE.—Men⁶ are more prone than women to

¹ *Renal and Urinary Diseases*, 1896, p. 240.

² *Ib.* p. 243.

³ *Diabetes Mellitus*, 1898, p. 110.

⁴ ‘The Measure of Physical Fitness for Life in the Tropics,’ *Lancet*, December 14, 1901, p. 1672.

⁵ *Ib.*

⁶ *Renal and Urinary Diseases*, Saundby, 1896, p. 245.

diabetes as 3 : 2 (Saundby). It is probable that the difference is connected with the periodic acarbonization of menstruation, for, in childhood and up to puberty, the sexual incidence of the disease is practically identical: ‘as¹ age advances the proportion becomes nearly two males to one female, until in old age it comes back to the equality of childhood’ (Saundby).

Frerichs thinks that women at the *menopause* are more than usually prone to diabetes; and Saundby² says that, in some instances, there is an apparent connexion between the onset of this disease and the climacteric. I have frequently dwelt on the special tendency to hyperpyraemia and glycogenic distension of the liver which exists at this period of life.

§ 686. OBESITY.—The close connexion between obesity and diabetes is recognized by all authorities. ‘Seengen³ said that 30 per cent. of the cases he had analysed were excessively fat at the beginning of their illness.’ I have suggested already (§ 146) that a low grade of the hepatic glycogen-forming capacity may be a factor common to both obesity and glycosuria; and that the former differs from the latter mainly in the existence of a compensatory high grade of the fat-forming capacity. This view explains the frequency of obesity amongst the antecedents of glycosuria: the succeeding glycosuria owns a community of causation with the obesity, and arises in spite, not in consequence, of the exaggerated fat-formation.

This is practically the view of Saundby, who says:⁴ ‘It is probable that one of the first results of excess of sugar poured into the circulation is an increase of fat, and so long as the surplus sugar can be stored up in this way, glycosuria is postponed. But a time comes, when either the activity of the liver is greater and the sugar is more than can be so stored up, or the limits of the fat-forming capacity are reached, and then sugar appears in the urine.’

From my standpoint I should prefer to regard any liver change responsible for glycosuria as a loss of function—a diminution in the capacity to dehydrate sugar and detain it in the form of glycogen; and to this impairment of function might be ascribed two important results: (1) an increase of glycaemia; and (2) an increase in the power of digestion and absorption of food, with probably an increase of appetite.

¹ *Renal and Urinary Diseases*, 1896, p. 245, Saundby.

² *Ib.* p. 257.

³ *Ib.* p. 247.

⁴ *Ib.* p. 248.

Further, it is clear that the glycosuric stage will be reached sooner, other things being equal, in persons who are deficient, from congenital or other reasons, in the fat-forming capacity : conformably, it is a well-recognized clinical fact that cases of glycosuria in the habitually lean tend to arise earlier in life, and to be proportionately severe.

§ 687. PYREXIA.—It has been argued that prolonged pyrexia tends, in many cases, to induce hyperpyraemia during convalescence (§ 230). Glycosuria also may arise in the same circumstances. Williamson says:¹—‘ Symptoms of diabetes are sometimes first noticed soon after an attack of one of the specific fevers, such as typhoid fever, scarlet fever, cholera, diphtheria, etc. ; and occasionally diabetes follows an acute illness, such as acute rheumatism, acute tonsillitis ’ ; he also saw cases following pleurisy and pneumonia. I have myself traced several cases to the convalescent stage of typhoid : one such has been referred to already (§ 333).

The post-pyrexial origins of hyperpyraemia and glycosuria argue a similarity, though not of course an identity, of causation. The post-pyrexial origin of hyperpyraemia has been ascribed to the exaggerated disintegration of the active nitrogenous tissues which occurs during pyrexia, and to the consequent inadequacy of decarbonization, katabolic or anabolic or both : such inadequate decarbonization would throw an extra strain upon the hepatic function of restricting the carbonaceous income ; and it might be that such extra strain would result in a breakdown of this function. At the same time, we must admit the possible influence of pyrexial disintegration of the liver cells, leading directly to impairment of the glycogenic function, and consequent impairment of the regulation by the liver of the carbonaceous income to the general circulation.

Post-pyrexial glycosuria is explicable similarly by inadequate power on the part of the disintegrated tissues to deal with sugar, whether by katabolism or anabolism or both. But here it seems probable that impairment of the glycogenic function through pyrexial disintegration of the liver cells plays a more important part than in hyperpyraemia. At any rate, it seems almost certain that in cases such as the one described in § 333 the latter factor is the immediate cause of the glycos-

¹ *Diabetes Mellitus*, 1898, p. 111.

uria: otherwise, it would be difficult to explain satisfactorily the complete cessation of the periodic migraine.

§ 688. BOUCHARD'S STATISTICS.—These are strongly confirmatory of the view that glycosuria and hyperpyraemia may own common factors in causation. They show that the most common pathological antecedents or concomitants in cases of diabetes are those affections which are ascribed in this work to hyperpyraemia, to the associated glycogenic distension of the liver, or to the factors, or results, of these conditions. Thus in 100 cases of diabetes, Bouchard¹ finds obesity 43 times, migraine 18 times, acute rheumatism, gravel, and eczema (compare § 820 *et seq.*) each 16 times, biliary lithiasis (compare § 96) 10 times, chronic articular rheumatism (compare § 846 *et seq.*) and various neuralgias (compare § 480) each 8 times, urticaria (compare § 820) and various haemorrhages (compare § 668 *et seq.*) each 6 times, pityriasis (compare § 820) 4 times, asthma and gout twice. The same author strongly supports the view that some cases of diabetes depend mainly upon 'a diminution² of the aptitude of the tissues to burn up sugar,'—an incapacity which is a specification of the 'deficient katabolic decarbonization' of this work.

§ 689. THEORY OF DIABETES.—No one will imagine from the foregoing paragraphs that I am attempting to establish a complete theory of a morbid process so complex as diabetes. The form of diabetes which mainly concerns us is commonly termed 'alimentary glycosuria,' which, however, is admitted by most authorities to graduate at times into the severer forms of the disease; and if I have adduced evidence sufficient to make it probable that this variety owns some factors in common with hyperpyraemia, that will be enough for the purpose of this argument.

There is no physiological standard for the sugar-dehydrating function of the liver: Pavy has shown that it may exist in all grades. And it is the due relation of this function to the sum of those functions which remove sugar from the blood-stream that normally prevents glycosuria. In any given case, this physiological relation or balance may be disturbed by a diminution of the sugar-dehydrating function of the liver whereby more sugar escapes into the general blood-stream, or

¹ *Les Maladies par Ralentissement de la Nutrition*, 1890, p. 186.

² *Medical Annual*, 1902, p. 298.

by a diminution of combustion, formation and deposition of muscle glycogen, fat-formation, menstruation, etc., whereby less sugar is removed in a physiological manner from the general blood-stream. Thus probably glycosuria may arise from numerous different proximate causes.

I can hardly doubt, however, that, in a certain well-defined class of cases, the pathological change which immediately antecedes the appearance of sugar in the urine is a diminution of the sugar-dehydrating capacity of the liver, and a consequent diminution in the hepatic capacity for glycogenic distension. Otherwise, it would be impossible to explain the marked increase in digestive power and appetite which so frequently announces the commencement of glycosuria. Conformably, Ehrlich¹ states 'that very little or no glycogen can be found in fragments of liver withdrawn by a trocar from diabetics during life.'

This breakdown in the sugar-dehydrating, or glycogenic, function of the liver, it seems reasonable to ascribe, in some cases, to physiological strain associated with long-continued, or frequently repeated, glycogenic distension from hyperpyrexia: in others, to pyrexial disintegration: in others, to a loss of that vaso-motor function which, I have argued, renders possible the glycogenic function and the occurrence of glycogenic distension (§ 442 *et seq.*); and in others again, to some combination of these factors. The first of these views is consistent with the clinical observation that glycosuria often results from excess of sugar and starch: the second with post-pyrexial glycosuria: the third, with the origin of glycosuria from nervous causes, such as shock or grief; while none of them are inconsistent with the existence of cases of diabetes depending upon pancreatic disease or degeneration.

C. Reissmann² reviews the evidence in favour of a pancreatic factor of diabetes. He points out that in 1869 Langerhaus demonstrated that there exist in the pancreas, besides the proper secreting structure of tubular alveoli, certain highly vascular patches or clumps of epithelium-like cells. These cell-islands . . . are seen as rounded elongated masses of cells. . . . These cells have no connexion whatever with the pancreatic duct. They are found in the inter-glandular con-

¹ *Renal and Urinary Diseases*, Saundby, 1896, p. 232.

² *Australasian Medical Gazette*, August 1903, p. 340 *et seq.*

nective tissue. . . . Each clump of cells is surrounded with a rich network of blood-vessels.' A long series of laboratory experiments, as well as many histological examinations of the pancreas in fatal cases of diabetes, tend to the belief that the cell-islands are ductless glands which elaborate and pass into the blood-stream some internal secretion, presumed to be essential for the prevention of diabetes. It is admitted that the nature and mode of action of this internal secretion are quite unknown. Meanwhile, therefore, we may hold the view provisionally that the presence of this internal secretion in the blood is no less essential for the due performance of the glycogenic function of the hepatic cells (dehydration of sugar) than is an adequate supply of arterial blood: indeed we might perhaps regard the increased supply of this unknown secretion as the meaning of the increased arterial supply which takes place whenever the glycogenic function is in full operation. This conception would perhaps involve the assumption that the internal secretion in question is delivered by the hepatic artery, not by the portal vein; and, in the way of this, there is an obvious anatomical difficulty. But it is quite conceivable that the internal secretion passes in the first place by the portal venous system through the liver, becoming further elaborated in the general circulation or in some of the glandular tissues of the organism, and that it is thereafter delivered in a finished condition by the hepatic artery. For, generally speaking, it seems more appropriate that a material essential for *function*, as distinguished from *supply*, should be delivered by arterial channels.

There remain, of course, many circumstances connected with diabetes which the views, here advanced, are incapable of explaining. For example, the persistence of glycosuria in some cases after the withdrawal of all food cannot be explained by incapacity on the part of the glycogenic function of the liver. It may be that, as some have held, the constant presence of sugar in excess in the circulating fluids exerts an actually poisonous action upon the tissues of the body; and there are many other possibilities demanding investigation: it seems possible, for example, that inadequacy on the part of the glycogenic function of the muscles is a factor in some cases.

SPECULATIONS AS TO THE PREDISPOSITION TO CONSUMPTION

§ 690. The following speculations are very largely, if not purely, fanciful: they are immaterial as regards the main purpose of this work, and may therefore be omitted by the general reader. My excuse for their inclusion is that they seem to provide some new view-points; and that they will serve to emphasize the existence of the personal factor or predisposition in tubercular phthisis, the which seems to me to have slipped into the background of late years rather more than is expedient.

The importation into the argument for hyperpyraemia of the microbic factor opens up a fresh speculative vista. If we suppose that in the case of some of the specific affections there is the predisposition of hyperpyraemia, we shall be in a position to regard the microbe in the light of an auxiliary, called in to assist in the work of acarbonization,—we may imagine that the organism makes use of the opportunities afforded by its environment, as well as of its congenital or acquired capacities.

But it is clear that the organism which invokes microbic aid does so at enormous risk. For it will, in all probability, be a mere matter of chance, whether the microbe, so invited, is comparatively harmless—as in the case of the supposititious microbe of infectious catarrh—or capable of retaining a permanent hold upon the tissues of the body, and causing progressive disease—as in the case of tubercle bacillus. It may be that clinically we see these risks daily incurred. The thin weakly and sedentary person of unhealthy occupation is often the subject of recurrent catarrhs, nasal, tracheal, and bronchial, for many years, before he is unfortunate enough to become infected with the tubercle bacillus. It was inevitable that for centuries these antecedent catarrhs should have been looked upon as directly causative of the more serious disease: it was surmised that frequent catarrhs led to phthisis through the damage inflicted upon the respiratory mucous membrane: consumption was purely a matter of neglected colds, and the influence of this belief is with us still. Later, the discovery of the bacillus tuberculosis led to an important modification of this view: it was supposed that frequently recurring catarrh so

damaged the respiratory mucosae as to render them a favourable soil for the incidence and development of this microbe. Nor is this supposition inconsistent with our present speculations ; for, as already argued, hyperpyraemic conditions are probably responsible in many cases for frequently recurring catarrh. On this view, hyperpyraemia would enter but very indirectly into the predisposition to tuberculosis. But it is open for us to consider whether the connexion is not more direct—whether the long-recurrent catarrhs and the tuberculosis may not own a predisposition in common, and whether this, in some cases, may not consist of hyperpyraemia. It is hardly necessary to refer to the probability that, in some cases, the antecedent catarrhs are in reality manifestations of incipient tuberculosis, not diagnosed as such.

The view that hyperpyraemia constitutes, in some cases, a direct predisposition to tubercular phthisis, is supported by evidence, which is certainly vague and uncertain, but which may be worth stating.

§ 691. Food.—It has been argued that hyperpyraemia may arise through a deficiency of proteid, as well as through an excess of carbonaceous food-stuffs (Table III). Conformably, Professor J. Bauer says:¹ ‘The one-sided and defective diet one most often meets with in daily life is that in which there is a deficiency of albuminates, but a great excess of carbohydrates, a proportion owing to the composition of those vegetable foods on which the poorer classes are necessarily largely dependent for support.’ The author points out that the condition of the body induced by such a food-supply involves a considerable diminution of strength and of power to resist injuries, and is without doubt closely connected with the development of dyscrasiae, such as scrofulosis, tuberculosis, etc.

Deficient proteid leads to deficient function generally, and therefore to deficient carbonization and deficient decarbonization. A preponderating deficiency of the former would tend to hypopyraemia : a preponderating deficiency of the latter, to hyperpyraemia. Possibly either departure from physiological pyraemia may enter into the malnutrition which conduces to pulmonary tuberculosis.

§ 692. EXERCISE, AIR, AND TEMPERATURE.—All those

¹ Ziemssen's *Handbook of Therapeutics*, vol. i. p. 160.

hygienic conditions so often enumerated, such as outdoor physical exercise, which tend to prevent hyperpyraemia and to render unnecessary pathological carbonization of all kinds, are precisely the conditions which render consumption uncommon, or tend to ameliorate it when present. On the other hand, conditions including deficient physical exercise, prolonged confinement in hot ill-ventilated workshops, etc., which are undoubtedly favourable to hyperpyraemia, are notoriously amongst the commonest antecedents of consumption. I do not seek to undervalue the influence of the last conditions in causing aggregation of the bacilli, and thereby increasing the chances of infection. On the contrary, it is clear that the environment which, I am supposing, may lead to the necessity for microbial assistance, is precisely the environment which enables the army of bacilli to concentrate in force.

The effect of external temperature on many phthisical patients may point to a continuance after infection of the suggested antecedent hyperpyraemia. It has long been held that the English winter season is injurious; but, even before the advent of the open-air treatment, certain physicians stated that there was a tendency to an annual exacerbation in the severity of the disease during early summer. And at the present time, it is generally admitted that cold *per se* is harmless, if not salutary, and that the injurious effects of the English winter are due almost solely to confinement and bad ventilation. Dr. A. J. Turner informs me that, in the North London Hospital for Consumption, where patients live and sleep the year through upon an open verandah, the cases do better in the winter than in the summer. And I do not question that this is true of Queensland, where many consumptives lose as much ground in the summer as they gained in the previous winter.

§ 693. AMENORRHOEAL HYPERPYRAEMIA.—It would seem that the tendency to hyperpyraemia which may be associated with deficient or absent menstruation, whether during the reproductive period of life or at the menopause (§§ 172 and 174), may sometimes accompany an outbreak, or an exacerbation, of consumption. Tilt saw this disease aggravated in three cases by the menopause. ‘Dubois¹ also mentions that two ladies, who were saved from phthisis by the regular

¹ *Change of Life*, 1882, Tilt, p. 289.

establishment of the menstrual flow, fell victims to the complaint at the change of life, without any other apparent cause. B. du Boismont says that in ten cases he has been spectator of the rapid progress at this epoch of cases of consumption which had long been stationary. More recently Dr. Emmett, of New York, has stated that dysmenorrhoea, by causing the early cessation of menstruation, is a frequent cause of phthisis in comparatively young women.' It is, of course, highly probable that, in many cases of phthisis associated with amenorrhoea, the latter has succeeded the former and is a conservative measure adapted to economize material.

§ 694. PREGNANCY.—'The view¹ was long held that pregnancy afforded an immunity against' tuberculosis, 'and that if it commenced while such a disease was present, the latter would run a milder course and, in some cases, become latent, while, on the other hand, parturition rapidly aggravated the disease.' Spiegelberg says:²—'The latter idea is as true as the former is false.' Yet it would seem that he does not altogether abandon the former, for he says:³—'It cannot be denied that occasionally disorders which existed previous to pregnancy do appear to be alleviated'; and again:—'How⁴ slight a protection is afforded by pregnancy, is shown by the fact that acute tuberculosis may develop during it, and run so rapid a course that death occurs before the termination of pregnancy: extremely dangerous pulmonary haemorrhages have also been observed in pregnant women.'

Acute miliary tuberculosis is a comparatively rare affection, and one so rapid that, in some cases, its duration can only be reckoned in days: I have seen one undoubted case which proved fatal on the beginning of the sixth day from the onset, which was sudden and came on during robust health. It is hardly to the point, therefore, that pregnancy should afford no protection against this variety of tuberculosis. The peculiar liability to dangerous haemoptysis is explained by the physiological high blood-pressure which rules in pregnancy. As regards the more chronic forms of tubercular consumption, I have seen several cases in which the symptoms remained distinctly in abeyance throughout pregnancy; and I know of several medical men who have made similar observations. At any rate, the general

¹ *Text-book of Midwifery*, Spiegelberg, New Syd. Soc., vol. i. p. 362.

² *Ib.*

³ *Ib.*

⁴ *Ib.* pp. 362, 363.

impression that such is often true, is, I think, too widespread to be finally negatived by the opinion of one or two observers however eminent.

§ 695. FAT-FORMATION.—Though it is undoubted that stout persons are not immune from phthisis, it will hardly be disputed that those who are habitually lean are, other things equal, more likely to contract the disease; and it has long been recognized that the commencement of pulmonary consumption may be preceded by a condition of ill health and malnutrition, which, in some cases, is of prolonged duration. On the other hand, no one will deny that, as a *general rule*, improvement in the pulmonary lesion goes hand in hand with increasing weight; and it may often unfortunately be noted that improvement ceases with the cessation of the augmentation of weight. Of course all these observations are capable of more than one interpretation.

§ 696. PYREXIA, INCLUDING GOUT.—The view has been expressed that persons suffering from consumption are less liable than others to specific diseases, such as typhoid; but, if there be any such immunity, it is far from complete, for many tubercular subjects contract typhoid. In such, however, the symptoms of the latter have been, in my experience, for the most part of moderate severity; and, in many, the manifestations of the pulmonary disease have undergone marked modification during the intercurrent infection. During the recent epidemics of dengue in Queensland, I saw many consumptives attacked, and, in most of these, the symptoms referable to the pulmonary lesion were in marked abeyance during the short and sharp pyrexia of the epidemic disease. In several, some of which were advanced and presented extensive excavation, *cough and expectoration ceased completely*, and auscultation showed that the habitual excessive secretion had stopped for the time being. In some cases, the improvement in pulmonary symptoms during intercurrent pyrexia was prolonged into convalescence, and it seemed that a more or less permanent improvement occurred in one or two. Percy Kidd says:¹—‘An attack of erysipelas has been followed by arrest of the pulmonary disease in a few recorded instances.’

We have classified gout as a pyrexial acarbonizing process,

¹ Clifford Allbutt's *System of Medicine*, vol. v. p. 164.

and pyrexial phthisis must, of course, be included in the same category. This may partly explain why the two occur but rarely in the same individual: why, when they do, they alternate 'just as¹ asthma and gout do' (Haig); and why, in the latter circumstances, there is apt to be a modification of symptoms. Percy Kidd says:²—'In the rare instances in which gouty persons acquire tuberculosis, the disease runs a very chronic course.' This does not, however, apply to those who are in a state of advanced gouty cachexia.

Now it is conceivable, on the one hand, that long-existent chronic gout, which has ceased to promote efficient acarbonization, and which, as we shall see later (§§ 843, 844), is necessarily associated with a state of unrelieved hyperpyraemia, may permit of reinforcement by the tubercular process. Ewart says:³—'Tubercular phthisis, in a small proportion of cases, is a final complication of advanced cachexia. At this stage, gout does not appear to exert, as in the earlier periods, a prophylactic influence against bacillary disease. On the contrary, the lesions of phthisis are apt to run a more than usually rapid course in the unhealthy tissues of the gouty cachectic.'

It is conceivable, on the other hand, that chronic apyrexial phthisis may be inadequate as an acarbonizing process and may, consequently, become reinforced by articular gout; and 'Dr. Pollock⁴ showed that gout, when developed in a phthisical subject, possessed inhibitory power and checked the tubercular process, the pulmonary symptoms being relieved; and that, in such cases, the disease was protracted and a prognosis for chronicity was warranted.'

It need not be inferred that the antagonism between gout and tubercle concerns only their common acarbonizing influence. I have been careful to avoid assuming that hyperpyraemia implies a complete description of the blood, arguing that it has reference to one item only, namely, the carbon contents of the blood (§ 198); and it seems highly probable that, even if they own a common factor in hyperpyraemia, the two diseases, gout and tubercle, differ widely as regards the associated conditions of the blood; further, it may be that the condition which

¹ *Uric Acid in Disease*, Haig, 1897, p. 318.

² Clifford Allbutt's *System of Medicine*, vol. v. p. 165.

³ *Gout and Goutiness*, Ewart, 1896, p. 204.

⁴ *Treatise on Gout*, Duckworth, 1890, p. 172.

permits of gouty acarbonization, is actually hostile as a rule to tubercular acarbonization ; and conversely. Sir Andrew Clark¹ ‘ evidently thought that by eating a large amount of animal food, he was cured of his phthisis and got gout in its place ’ (Haig) ; and it can hardly be doubted that he was correct in this opinion.

§ 697. Elsewhere it has been argued that pyrexia, though an acarbonizing process, is, especially when prolonged, peculiarly liable to be followed by hyperpyraemia. Hence, possibly, the fact that many cases of consumption date approximately from the departure of long-continued fevers, such as typhoid ; and we can readily imagine that long-continued fevers, associated with inflammatory lesions of the respiratory mucosae, such as broncho-pneumonia, will be, more than others, liable to such a sequela.

§ 698. PAROXYSMAL NEUROSES.—If hyperpyraemia enters into the predisposition to phthisis, a certain degree of immunity may be expected to accrue from the periodic recurrence of the paroxysmal neuroses, as from other acarbonizing processes. Now I believe I am right in stating that there is a certain vague impression, both within and without the profession, that recurrent affections, such as bilious attacks and migraine, are to some extent defensive against more serious diseases ; and ‘ the² susceptibility of epileptics to infectious diseases is very slight according to the best authorities. Romberg states it to be very much decreased, and many others agree with him ’ (Hobart A. Hare).

Of course we must admit that such defence, if it exist, is frequently overridden : tubercular consumption does arise in ‘ neurosal ’ patients, and then in many cases, as already stated, the neurosis, having no further reason for its recurrence, ceases finally. Watson relates that a physician of his time used to endeavour to bring about asthma in his patients in order to protect them from consumption. Commenting upon this practice, he says :³—‘ It may be that persons affected with genuine asthma seldom become victims of pulmonary consumption ; but I am sure the rule is not universal. One of my earliest friends had from time to time, while we were school-

¹ *Uric Acid in Disease*, Haig, 1897, p. 318.

² *Epilepsy : its Pathology and Treatment*, H. A. Hare, 1890, p. 221.

³ *Principles and Practice of Physic*, Watson, fourth edition, vol. ii. p. 360.

fellows and long afterwards, the most exquisite fits of spasmodic asthma. At length, when he was between thirty and forty years of age, they wholly ceased ; whereupon he greatly congratulated himself. But they only yielded before a worse disease. He began in a few months to spit blood ; and in a few more, he died of well-marked phthisis.¹ In all probability such a case of phthisis would have been frankly pyrexial : it would at least have been associated with marked increase in the rate of combustion (§ 278).

Now whether it depends in any degree upon hyperpyraemia or not, it is clear that phthisis is antagonistic to asthma, since asthma may depend upon hyperpyraemia, and both affections are acarbonizing processes. But, since phthisis is more or less continuous and asthma for the most part intermittent, any interchange would be, as a rule, from the latter to the former, and not reversely. I have, however, seen slight asthma arise for the first time in a patient who had recovered from early consumption. And I have no doubt that some chronic phthisical patients, apyrexial or but feebly pyrexial, do suffer from hyperpyraemia and from some of its asthmatic manifestations. Many have various degrees of wheezing, especially between 2 and 5 A.M. ; also after sleep at any time ; and within a short time after meals. Sleep after meals is especially apt to cause this symptom, which can be relieved by some restriction of the carbonaceous intake, by iodide of potassium, exercise, etc., just as in the ordinary form of asthma. In many of these cases, I have found the high-tension pulse referred to by Broadbent :¹ in others, attacks of angina pectoris and numerous forms of neuralgia.

The view has already been entertained that pathologically prepotent paroxysmal neuroses, by inducing recurrent hypopyraemia, may lead to malnutrition, and that such malnutrition may constitute a predisposition to many infective diseases (§ 569). Amongst these may be tubercular consumption.

§ 699. TREATMENT.—If we admit that hyperpyraemia, or the malnutrition which may result from hyperpyraemia, enters into the predisposition to tubercular phthisis, it will follow that the avoidance of the causes of hyperpyraemia is an important item in prophylaxis. But it will by no means necessarily follow that the treatment of existent phthisis is identical with

¹ *The Pulse*, 1890, p. 161.

the treatment of hyperpyraemia. In taking a comprehensive survey of disease, we shall often be forced to admit that pathological processes may be conservative, and yet be more destructive to the organism than the condition which they are adapted to combat; and consequently, that such conservative action calls more urgently for treatment than its *raison d'être*. Further, in the special case under consideration, namely phthisis, we shall feel certain, that, in many cases—more especially of course in such as are at all acute—any antecedent predisposing hyperpyraemia will have already been dispersed.

Consistent with this theoretical deduction are the important experimental observations reported by Robin and Binet, which demonstrate that in some cases of phthisis the rate of combustion greatly exceeds the normal (§ 278). From these observations the authors quoted infer that the 'pretuberculous' stage must be viewed as one of irritable and augmented, rather than of depressed, vital action.' From our point of view, such an inference is quite unwarranted; for, while there is nothing to show that the pretuberculous stage is characterized by augmented vital action (combustion), there is ample reason to anticipate that such will result, in most cases, from the supervention of the tuberculosis.

Now it seems more than probable that in such cases of already existing phthisis the reduction of the exaggerated combustion of the fixed tissues will constitute the most urgent indication for treatment. Herein we may find an explanation of the highly beneficial action *in some cases* of over-feeding with a highly carbonaceous mixed diet. Experimentally, the administration of fats and carbohydrates has been shown not to increase largely the rate of combustion (§ 13): this is true even of the most absorbable of the carbohydrates, namely glucose, which, I may remark, has given in my hands apparently good results in some cases of pyrexial phthisis. Though there is, of course, some increase of combustion following the ingestion of the carbonaceous food-stuffs, yet such increase is at the expense mainly of the food-stuffs, and not of the fixed tissues: the latter, indeed, are known to be spared.

At the same time, it must be admitted that some cases of phthisis—always in my experience chronic apyrexial cases—are prone to suffer from some of the manifestations of hyper-

¹ *Progressive Medicine*, September 1902, p. 51.

pyraemia, such as high blood-pressure, headache, slight asthmatic dyspnoea, anginal and various neuralgic paroxysms; and it is clear that certain items in the sanatorium treatment, more especially physical exercise, are such as tend materially to increase the rate of combustion or katabolic decarbonization. Further, it will, I think, be admitted, that under any kind of forced feeding, improvement occurs, mainly, if not solely, in those cases which increase in weight—in those which, in other words, retain in some material degree the capacity for fat-formation or anabolic decarbonization. In the absence of any increase in weight, it is my experience that forced feeding is almost always injurious.

§ 700. From these considerations, it seems to me, we may deduce some general principles of treatment. In *all* cases, a maximum amount of fresh air is to be allowed. In *pyrexial* cases, with low-tension pulse, etc., we should aim at anticipating excessive tissue combustion, by rest and by a diet scale which, while containing a sufficiency of proteid to replace the increased nitrogenous waste connected with the disease, contains also easily digestible fats and carbohydrates, especially soluble carbohydrates, sufficient to reduce the tendency to exaggerated disintegration of the fixed nitrogenous and other tissues of the body.

In *chronic apyrexial* cases, associated perhaps with some of the manifestations of hyperpyraemia, such as high-tension pulse, vaso-motor headaches, and asthmatic respiration, we should aim, after paying due attention to the digestive organs, at increasing the physiological decarbonizing capacities of the tissues, more especially, perhaps, the capacity for fat-formation. To this end, we should employ physical exercise, progressively increased but always stopping short of fatigue and distinct increase of temperature, a due supply of proteid, and a carbonaceous supply which does not exceed the sum of the decarbonizing capacities. So far as I can see, this carbonaceous supply varies widely in amount: herein no two cases seem to agree. Those who do best are those who can digest and assimilate, without developing hyperpyraemic manifestations, a heavy carbonaceous supply: these are the cases which rapidly gain in weight. But it is not difficult to overdo alimentation, even in these cases; and, in those who lack the capacity to form fat rapidly, it is extremely easy to do so. I have often

seen cases in which increased dyspnoea, especially nocturnal and after meals, increased pulse-tension, headache, and severe dyspepsia (probably usually of the secondary variety, see § 78), have followed excess of food; and I have watched the disappearance of all these troubles on a reduction in the amount of food. It is mainly, I think, in these cases that physical exercise is invaluable: other things being equal, a considerably increased carbonaceous intake can be dealt with physiologically, after an increase in physical exercise; and, contrary perhaps to what might be anticipated on purely theoretical grounds, a material increase in fat-formation often results. There are some cases of chronic phthisis, apyrexial but greatly debilitated as regards the muscular system, in which physical exercise in any effectual degree is invariably followed by exhaustion: this is especially applicable to hot climates. In these, I have found general massage, combined with mild faradization, a serviceable substitute.

It seems to me that the above-sketched plan of treatment, founded, as it is, largely upon physiological principles, conforms pretty accurately with the usual practice which is pursued in sanatoria and which has, in the main, been founded upon accurate clinical observation—that, in short, deduction and induction harmonize generally. But it would be idle to deny that we meet with numerous exceptions, or apparent exceptions,—cases which do not answer satisfactorily to these general therapeutic principles; and, in the treatment of such, I have no hesitation in saying that a purely inductive view is preferable.

SPECULATIONS AS TO THE PREDISPOSITION OF CANCER

§ 701. It is generally admitted that cancer—using the word in its widest clinical sense—is increasing; and it seems to me that this fact, together with our almost complete ignorance of the pathology of so fatal an affection, has led to some relaxation of the bonds which the inductive method of reasoning has placed upon the investigation of disease. At any rate, more or less imaginative speculations as to the causation of cancer have been rife of late, and many of these have been freely admitted into the medical press. I may perhaps be permitted

here to add yet another to the list of these imaginative speculations.

We have seen valid reason to believe that cancer may play the part of an acarbonizing process (§ 281), but this gives us no right to regard hyperpyraemia as a factor in its causation. Still there are certain considerations which do seem to point to such a conclusion—to the conclusion that cancer may be a late manifestation of hyperpyraemia. It may here be stated that, should this anticipation be borne out finally, that will have no necessary bearing, hostile or other, upon the view that cancer is a parasitic disease: here, as elsewhere, the humoral and microbic factors are eminently compatible.

§ 702. THE PHYSIOLOGICAL ASSOCIATIONS OF CANCER.—The conception that cancer may be a late manifestation of hyperpyraemia harmonizes with the age incidence of the disease. Tilt says:¹ ‘Out of 1,200 cases extracted by Dr. Walshe from the Registrar-General’s returns . . . only fifty . . . occurred before thirty years of age.’ He appends a table showing that the maximum incidence of cancer in women is upon the decennium included between forty and fifty years of age; and he says:² ‘The influence of cessation on the march of cancer of the womb is evident: sometimes cessation coincides with the first manifestation of uterine cancer, as in six out of Lebert’s eighteen cases, and in twenty-seven out of fifty-three of my own. More frequently, it gives activity to cancer of the womb that had previously remained undetected.’

Most of the above applies to uterine cancer; and it might be urged that the local changes involved in the uterine involution at the menopause are the exciting factors of the cancer. But this is improbable, for the age incidence of mammary cancer is practically identical. ‘Galen³ noticed that cancer of the breast was frequent at the change of life, Sir James Paget has shown that it occurs most frequently from forty-five to fifty years of age, and Dr. Gross observes that during the change of life . . . myxoma and all kinds of cancer’ (of the breast) ‘make their appearance.’

Of course, at the menopause there is a mammary, as well as a uterine, involution, and it might be held that amongst the structural changes therein involved is to be found the exciting factor of cancer. But against this as an exclusive view is the

¹ *Change of Life*, 1882, p. 259.

² *Ib.*

³ *Ib.* p. 261.

fact that the age incidence of cancer of all kinds is seemingly identical in women, and indeed diverges but slightly in men. This is shown in the following table from the forty-seventh Annual Report of the Registrar-General, quoted by Newsholme.¹

TABLE V.
Ratio of Total Deaths from Cancer, 1871–80.

Age-periods	Total Deaths to one from Cancer		
	Persons	Males	Females
20–	255	262	248
25–	71	131	49
35–	24	57	15
45–	14	28	9
55–	14	22	10
65–	21	27	17
75 and upwards	48	56	44

Concerning this table, Newsholme says:²—‘The liability to cancer increases with age; but, as the same may be said with equal truth about the liability to death generally, the question is, Does the liability to death from cancer increase more rapidly than the liability to death of all kinds? . . . It will be seen that the liability to death from cancer increases much more rapidly than the liability to death generally up to the 45–55 age period; but that, after this age, the general mortality increases more rapidly than the mortality from cancer.’

It is open for us to imagine, therefore, that the increasing liability to cancer which characterizes the successive age periods up to 44–55 is due largely to a concurrent increasing liability to hyperpyraemia. In women, the menopause which, we have seen, is especially prone to determine hyperpyraemia, is probably the important factor: in men, the important factor is probably the substitution of sedentary for active pursuits, with perhaps some increased appreciation of the culinary art. Such a conclusion would by no means exclude the view that local factors, irritant, involutionary, or other, co-operate in causation and largely determine the location of the malignant tumour.

It has been argued that during the physiological process of pregnancy hyperpyraemia is less than usually likely to arise, and is often indeed dispersed for the time being (§ 120); and

¹ *Vital Statistics*, 1889, p. 210.

² *Ib.*

I believe it has been noted in medical literature that, in some cases, the rate of progress of cancer has been retarded, if not inhibited, during pregnancy. Dr. Hawkes informs me of a case of cancer of the cervix uteri in which it seemed to him that the disease remained almost stationary during pregnancy : at least it rapidly progressed thereafter.

§ 703. THE PATHOLOGICAL ASSOCIATIONS OF CANCER.—Bouchard says :¹ ‘Enfin il est une terminaison singulière de la goutte par le cancer. Ce n'est pas chose nouvelle que le cancer se substituant comme maladie à la goutte ; Bazin avait dit : Les goutteux finissent surtout par le cancer et de préférence par le cancer du rectum ou de la vessie. Chez certains goutteux, à l'âge de cinquante ou soixante ans, les accidents qui venaient à l'automne ou au printemps ne viennent pas, et pourtant le goutteux ne mange plus, il a des douleurs dans le bas-ventre ; la dysurie se produit, l'état général devient mauvais, et le cancer du rectum ou de la vessie s'établit.’

Duckworth considers the gouty ‘somewhat liable to’ cancer. ‘In² ten fatal cases of gout, Pye-Smith records cancer in two instances in men. . . . According to Paget, gout and cancer are often found together, each pursuing its separate course, “the cancer in one part, the gout in another.” In treating of the succession of constitutional diseases, he declares it not to be rare to find a patient who has been scrofulous in early life, gouty in later life, and finally the subject of cancer. . . . Charcot noted at the Salpêtrière Hospital that women with Heberden's nodes’ (compare § 853) ‘were rather apt to be the subject of cancer of the breast and womb. This is of interest in respect of gout, which is certainly the cause of some forms of these ; and in one such case I met with cancer of the liver, and discovered uratic deposits in association with the digital nodes. I had a well-marked case of tophaceous gout under my care in a woman, aet. circ. 55, who died of cancerous tubera in the liver. William Budd recorded a case of cancer of the penis, with deposits in the liver and lungs, in a man of 68 who was the subject of true gout with tophi. Three examples of cancer of the stomach associated with gout are related by Lecorché, one in a man aged 50, one in a man aged 55, and a third also in a man aged 63. In France, cancer has

¹ *Les Maladies par Ralentissement de la Nutrition*, 1890, p. 282.

² *Treatise on Gout*, Duckworth, 1890, pp. 175, 176.

been thought to be especially frequent in persons of arthritic predisposition.'

Dr. Hawkes contributes the following life-history :—

A gentleman of 59 was operated on two and a half years ago for bleeding haemorrhoids. For ten or fifteen years prior to operation, he had suffered more or less from dyspepsia and biliousness, as well as from haemorrhoids. The operation was quite successful : he suffered no more from anal haemorrhage or discomfort. But all his digestive symptoms became rapidly exaggerated ; and he is now in the later stages of widely infiltrated carcinoma of the stomach.

It seems probable from this history that the malignant disease commenced subsequently to the haemorrhoidal operation, and was immediately due to the stoppage of haemorrhagic acarbonization.

To my mind, it presents no insuperable difficulty to imagine that an organism which has perhaps struggled for years against hyperpyraemia and which perhaps has taken full advantage of, and worn out, more than one of its special pathological acarbonizing capacities, such as gout for example, is driven ultimately to adopt the malignant anabolic acarbonization of cancer. If this is true, it will follow that an organism which lacks special pathological acarbonizing capacities will, in the face of long-continued hyperpyraemia, be even more likely to become affected by cancer. At any rate, the comparative rarity of pathological affections of all kinds in the life-histories of cancer cases has attracted the attention of more than one observer. Moore stated¹ that 'cancer is eminently a disease of persons whose previous life has been healthy, and whose nutritive vigour gives them otherwise a prospect of long life' ; and, on systematic investigation of the personal histories of cancer cases, such answers as 'Never had an ache or pain in my life,' 'Never knew what it was to be ill before,' etc., recur again and again.

Of course the implication in the latter part of this argument is that some persons suffer from prolonged hyperpyraemia which does not give rise to any subjective manifestations. This is difficult to prove, but it seems to me not improbable ; for we have all, I imagine, seen cases of sudden cerebral haemorrhage, leading to hemiplegia, in which, although the

¹ Quoted by Banks, *Brit. Med. Journal*, March 10, 1900, p. 559.

patients denied any previous indisposition and up to the time of the seizure had regarded themselves as robustly healthy, yet examination of the heart and arterial system has shown distinct objective evidence of prolonged high blood-pressure and, not infrequently, of commencing or even advanced degeneration. Now both these conditions, I shall argue, represent in many cases advanced results of prolonged unrelieved hyperpyraemia (Chapters XIX and XXIV).

§ 704. Whether or not hyperpyraemia enters into its etiology, there can be no doubt that pulmonary tuberculosis, except in its most chronic forms, is a pathological acarbonizing process of high potency: hence, as we have so often seen, the almost invariable subsidence of all the ordinary manifestations of hyperpyraemia at the onset of phthisis. If, then, hyperpyraemia predisposes to cancer, we should anticipate an antagonism between this disease and tuberculosis.

Conformably with this anticipation, ‘ MacCaskey¹ (“Amer. Journ. Med. Science,” July 1902) refers to the doctrine that Rokitansky is said to have taught that cancer and tubercle are incompatible. He considers that, owing to the extensive prevalence of both cancer and tuberculosis, their coexistence in one and the same individual ought to be fairly common were no influences at work to prevent this. In the course of many years of special enquiry and investigation in this direction, he only met with a single case of the kind, namely, a woman aged 45 years, of wasted appearance, and dying apparently from cancer of the liver and pancreas. Both lungs were found to be studded from apex to base with typical tuberculous nodules. This case was also of interest because it was marked by *absence of fever or of tachycardia*. In 281 necropsies of phthisical cases (136 by Williams and 145 by Kelynack), cancer was found four times, or in about 1·4 per cent. Stated otherwise and in accordance with statistical data, it appeared that phthisis was twenty times more frequent in the non-cancerous than in cancerous persons. The coexistence of cancer and *active* tubercle was rarer still.’ (The italics in the above quotation are mine.) I have dwelt upon the occurrence of hyperpyraemic manifestations in apyrexial phthisis (§ 698).

§ 705. THE THERAPEUTIC ASSOCIATIONS OF CANCER.—To my way of thinking, it is a fact highly suggestive of a hyper-

¹ *Brit. Med. Journal*, February 4, 1903, Epitome.

pyraemic factor, that, in many of the cases in which cancer has disappeared temporarily or permanently without operative interference, the associated circumstances, whether deliberately or accidentally induced, have been such as would be capable of promoting acarbonization of the blood. Thus cancer has been observed to disappear in circumstances which reduce the carbonaceous intake, in circumstances which increase the carbonaceous expenditure, and in circumstances which operate in both ways simultaneously.

There is a vague but old-standing idea in the profession that the increase of malignant disease is in some way associated with the increasing cheapness and improved quality of the world's food supply, or, what comes to the same thing, with the increase of wealth generally and with the consequent increase in the average quantity of food ingested and absorbed. This idea is, I believe, yearly becoming more widespread and more definite. Banks¹ voiced it in the Lettsomian Lectures for 1900. He says it was first put into his head by Sir James Paget, whose 'long experience had taught him that to starve the body as a whole probably meant starving the cancer locally,' and who was accustomed to advise patients to 'eat as little as possible.'

George Keith has, throughout an exceptionally long medical career, followed lines of dietetic management essentially similar to those laid down by Paget. He recalls a debate² on cancer in which 'two or three surgeons spoke of starvation as the only remedy for the disease'; and he mentions cases in which a spare and simple diet relieved pain, abolished the call for opiates, retarded the rate of growth, and manifestly prolonged life. He refers also to one case of mammary cancer³ in which the patient's digestion became 'so bad that she could only take for sustenance a very small quantity of milk. On this alone she lived for two years, and at the end of that period the cancerous growth had quite disappeared.'

It is true that practically all those who hold such views regard meat, particularly red meat, as the worst form of nutriment. But meat may be, and I doubt not is, quite commonly an important factor in hyperpyraemia. As already urged, the supply of proteid largely determines the carboniza-

¹ *Brit. Med. Journal*, March 10, 1900.

² *Fads of an Old Physician*, 1897, p. 82.

Ib. p. 84.

tion of the blood (§§ 55 to 60): consequently, with a mixed diet containing an excess of carbonaceous material—and this is the diet of the better classes the world over—a generous proteid supply may easily determine hyperpyraemia. But this is true only of a mixed diet containing a carbonaceous excess: by reducing the carbonaceous supply to the level of the fuel requirements of the organism or, perhaps for the time being, somewhat below this level, the supply of proteid ceases to have any pathological potentiality: hyperpyraemia is avoided or dispersed. And I am informed that some of those who practise the Salisbury method of treatment claim to have had good results in malignant disease.

The view that cancer depends in some part upon hyperpyraemia or upon the causes, or results, of hyperpyraemia, receives support from the fact, recently brought out by statistics, that the incidence of the disease follows with rather remarkable accuracy the consumption of beer. Munich is the centre of a large cancer area in which there is a maximum consumption of beer.¹ Beer, we have frequently seen, is one of the most prejudicial articles of diet in all hyperpyraemic affections.

§ 706. The treatment of inoperable cancer by double oöphorectomy was suggested and has been practised by Beatson; and ‘the favourable² results have been far too frequent to be due to chance, spontaneous cure, or errors in diagnosis. . . . According to Stanley Boyd, to whom we are indebted for the collection and analysis of fifty-four cases treated by oöphorectomy, six out of forty-six patients obtained immunity for two years and upwards, and seventeen out of forty-six derived some benefit, but in the majority the cancer reappeared, or began again to increase in from six to twelve months’ (Henry Morris).

As already pointed out, the natural menopause is succeeded in normal cases by a compensatory increase in the rate of combustion and in the output of carbonic acid (Chapter VI); and it is reasonable to infer that the same will be true of the menopause deliberately induced by double oöphorectomy. It seems likely that the increased combustion after the

¹ *Nineteenth Century and After*, June 1903.

² ‘Treatment of Inoperable Cancer,’ Henry Morris, *Brit. Med. Journal*. October 25, 1902, p. 1297.

menopause will be, in some cases, a more efficient means of acarbonization than the menstruation which it replaces: conformably, we have seen many of the manifestations of hyperpyraemia disappear at the menopause; and this may explain the occasional disappearance of cancer after double oophorectomy, assuming this disease to have a hyperpyraemic basis.

But I have also argued that, in other cases, the substitutive physiological acarbonization may be less efficient than the menstruation it replaces (§ 174): conformably, we have seen that the manifestations of hyperpyraemia may arise, or become accentuated, at the menopause; and this might explain the occasional appearance for the first time of cancer after double oophorectomy, for 'cases¹ have been reported by Rutherford Morison in which the removal of diseased ovaries is stated to have been followed by breast carcinoma.' The variable influence of ovarian involution upon the carbon contents of the blood is consistent with the variable influence of double oophorectomy upon cancer; and the temporary influence of the operation is still consistent, for there are so many ways in which hyperpyraemia may rearise.

§ 707. The treatment of inoperable cancer by thyroid feeding was also suggested by Dr. Beatson: in many cases, it is used as an adjunct to removal of the ovaries: in some, independently. Of its independent use Dr. Beaver² relates a remarkable instance:—

A lady of 51: advanced uterine cancer with large extra-uterine extension and considerable secondary deposit in the right lobe of the liver: patient extremely emaciated, confined to bed, and suffering great pain: case diagnosed as inoperable cancer by Sir John Williams and Sir Francis Laking, the latter of whom agreed that the only indication for treatment was the relief of suffering: the probable duration of life was estimated at less than one month. Of this case, Dr. Beaver says:—'I now' (end of November) 'determined to try the effect of thyroid extract. Commencing with five grains daily, the dose was quickly increased to twenty grains, with a result that was little short of marvellous. Convalescence began immediately, so that by the end of January the patient was up and free from pain. At this time, the various growths were much reduced in size,

¹ 'Treatment of Inoperable Cancer,' Henry Morris, *Brit. Med. Journal*, October 25, 1902, p. 1297.

² *Brit. Med. Journal*, February 1, 1902, p. 266.

and weight was being rapidly regained. When I last saw her in October, she was quite well and was following an active life: nothing abnormal was to be felt in the pelvis.

Thyroid extract is known to promote combustion and increase the output of carbonic acid.

' Eschweiler¹ of Bonn recently reviewed the treatment of inoperable malignant tumours by means of *inoculations of erysipelas toxins and serumtherapy*. His subject-matter comprised cases treated (1) with erysipelas toxins, either alone or combined with the products of the bacillus prodigiosus: (2) with erysipelas serum: (3) with cancer and sarcoma serums; and (4) cases of malignant tumours associated with erysipelas arising spontaneously or induced by inoculation. His conclusions were that the best results had been obtained with the true erysipelas infection, 25 per cent. having recovered; but the treatment was discredited by a high mortality, as six out of fifty-nine patients (or rather over 10 per cent.) died from the attack of erysipelas. Of the cases treated with the erysipelas toxins, either alone or mixed with the toxins of the bacillus prodigiosus, 16 per cent. are said to have recovered and three others to have improved; fourteen died during the treatment, some of them from the progress of the tumour itself. The erysipelas serum, and the cancer and sarcoma serums, were of little, if any, value. . . . True erysipelas infection alone gave more pronounced results, therefore, than the toxins or the serums. It thus appears that the more virulent the agent the more powerful is the effect upon the tumour, the more marked the curative action and the greater the danger to life' (Henry Morris). All this is consistent with the view that the exaggerated combustion associated with pyrexial conditions is the curative agent.

In the treatment by Coley's fluid, the pyrexial reaction is made the guide for dosage. 'The treatment² commences with half-minim (0·32 c. cm.) doses, daily increased by half a minim until the reaction temperature reaches 102° to 103° F. If no improvement is apparent after three weeks' treatment, it is useless, Coley states, to continue the injections. In most of his successful cases, marked improvement was seen within a week, but several months were required for complete cure.

¹ 'Treatment of Inoperable Cancer,' Henry Morris, *British Medical Journal*, October 25, 1902, p. 1295.

² *Ib.*

The treatment was founded upon the observation of cases of malignant disease in which improvement followed an attack of erysipelas' (Henry Morris).

§ 708. A CHEMICAL, BIO-CHEMICAL, OR METABOLIC HYPOTHESIS FOR THE ETIOLOGY OF CANCER.—John Rogers, jun.,¹ of New York, has recently advanced a humoral hypothesis for the etiology of cancer, which hypothesis seems to me entirely consistent with the hyperpyraemic hypothesis suggested in these pages. The two hypotheses were arrived at by widely different routes; and this seems to make their concordance the more striking and valuable. The author mentioned says:—‘In the last United States Census Report, the greatest increase in mortality is shown to be in nephritis, apoplexy, influenza, cancer, old age, and heart-disease. With the exception of influenza and for the present of cancer, all the rest may be said to belong to the connective-tissue degenerations, an evident disorder of metabolism which is universally ascribed to some “irritant” circulating in the blood. . . . This group of diseases . . . accompanies general prosperity, wealth, good and easy or strenuous living, with its nervous strain and interference with proper assimilation, oxidation, and excretion.’ Cancer ‘seems most common in the well-to-do, the well-fed, and the sedentary, and attention has frequently been called to its connexion in the same sense with gall-stones. The statistics compiled to show infected localities and houses have always seemed to me equally applicable to diet and mode of life, for low-lying rich soils along river bottoms are more productive and give greater creature comforts and ease than hill-sides and rocky soils. That certain dwellings or families suffer more than others, speaks no more for contagion than it does for cerebral haemorrhage or senility. The inhabitants may prefer or be forced to live in the same way. . . . The Teutonic and allied races are notoriously subject to malignant disease, and the sufferers from the malady have always seemed to me to present many close analogies to the well-to-do of other races. They are generally well nourished and fond of eating and alcoholic drinks, and are more or less sedentary and phlegmatic in their habits. In the lower animals, cancer seems unknown below the mammalia, and of these the carnivora, and particularly the omnivora, are much more subject to it than the

¹ *Annals of Surgery*, August 1903, p. 280 *et seq.*

herbivora, and, apparently, the more highly bred and domesticated the animal, the more apt it is to be attacked by cancer. These facts taken singly would have little significance, but grouped together and considered with the practical disproof of the parasitic theory, they are very suggestive.' Referring to the occasional success which follows the injection of erysipelas toxins, the writer says:—'A possible hint towards the solution is supplied by the fact that, during infectious diseases, the carbohydrates of the body, and particularly glycogen, are markedly decreased in amount. The starvation of malignant tumours by cutting off their blood-supply . . . seems to have considerable significance, especially when considered in relation to the results obtained by thyroid feeding and oophorectomy.' The writer points out that inoculation experiments are rarely successful, but auto-inoculation uniformly so, and says:—'A proper soil seems, therefore, to be a necessity, and this can be sought in nothing else than the constitution of the circulating blood, and I shall try to show that the carbohydrate group ought to be the first to be examined.' In support he calls attention to the 'recent discoveries as regards enzymes and their existence in all parts of the living body, and their necessity in metabolism. Every tissue appears to assimilate its nutriment and to carry on its existence by means of its enzymes and the reversibility of their action. Only a few of these mysterious entities have as yet actually been proved capable of reconstructing the complex organic bodies from the simpler soluble and diffusible substances into which, ever since the beginning of physiology, the digestive enzymes have been known to resolve such bodies. Nevertheless, there now appears to be no reasonable doubt but that this is the method by which all living matter exists. There are in general three groups of enzymes,—the proteolytic, the amylolytic, and the lipolytic . . . to which must be added a fourth or oxidative enzyme.' It has been known for some time that cancerous tissue contains enzymes, but Dr. Buxton, of the Cornell Medical College, has shown that the most abundant and constant enzyme present is the amylolitic. Conformably, glycogen 'is found in all tumours in a quantity varying directly with the malignancy of the disease. It is a colloidal, non-diffusible body, and its presence in the cells can only be explained by virtue of the enzymes they are known to contain.'

Rogers then points out that traumatism, which 'in one form or another is universally accepted as about the only apparent constant cause of cancer,' is 'always accompanied by more or less of an attempt at repair by granulations or an infiltration of embryonic round cells,' which, according to Dr. Buxton, contain considerable amylase; and suggests that these cells, 'by their enzyme, assimilate from the blood the carbohydrate to form the glycogen necessary for their life and growth, and, by the excess of nutriment present and by their own exuberant vitality in given instances, proceed to outgrow their natural limits in the shape of malignancy.' He suggests a series of experiments upon the carbohydrate contents of the blood in cancer cases; and he inclines to the view that the change in chemical constitution will be found to be a quantitative, not a qualitative, one. The whole of this hypothesis is entirely consistent with the view that cancer is an anabolic acarbonizing process dependent on hyperpyraemia.

§ 709. THE 'TUMOUR GERM' THEORY OF CANCER.—In the Bradshaw Lecture (1903) on Cancer and its origin,¹ Henry Morris reviews the various current theories on the nature and origin of cancer (carcinoma and sarcoma), and sums up strongly in favour of the 'tumour germ' theory of Durante and Cohnheim, with certain modifications. He says:—'Cohnheim referred the origin of carcinoma to the proliferation not of mature but of embryonic epithelial cells . . . which during foetal life are cut off from their proper connexions, remain in an undeveloped state, are surrounded by developing and ultimately developed tissues, and thus become, so to speak, embryonic inclusions. According to Cohnheim, these groups of germs, or "tumour germs," . . . remain in a quiescent or latent state until excited into activity by one or other of several causes at some indefinite period after birth. . . . Durante, Nicoladoni, Ribbert, and Senn embrace and supplement the incomplete theory of Cohnheim by recognising a post-natal origin of a cell matrix.'

As regards the causes which arouse the matrices into activity, Morris refers in some detail to four, namely, heredity, age, traumatism, and chronic irritation; but he points out that much more work is required 'as to the agencies which excite into action the invariable and unconditional cause of cancer.'

¹ *Brit. Med. Journal*, December 12, 1903, p. 1505 *et seq.*

If it is permitted to add to the exciting agencies, referred to by Morris, prolonged stimulation, perhaps of the nature of prolonged over-nutrition, of the cancer matrices by hyperpyraemia, then the hypothesis suggested in these pages becomes entirely consistent with the tumour germ theory.

One of the concluding remarks of the eminent surgeon just quoted, though applied to cancer research only, seems to me not inapplicable to modern pathological research generally. ‘The “high-power” lens and the fine adjustment, so to speak, have put into the background for the time being the binocular field glass with its adaptability for focussing the various features of an extensive perspective.’

SUMMARY

§ 710. In this chapter I have suggested that the three pathological conditions, namely, glycosuria, pulmonary consumption, and cancer (all of which we have already argued operate as continuous acarbonizing processes), may depend in part upon hyperpyraemia or upon some of the factors, or results, of hyperpyraemia. The arguments in favour of such an origin seem fairly sound in the case of glycosuria: in the case of the remaining two affections, they can hardly be regarded as more than speculative.

CHAPTER XVIII

§§ 711–721

Classification of the pathological acarbonizing processes depending on hyperpyraemia—Gradation of disease—Alternative systems of classification—The adopted system of classification.

GRADATIONS OF DISEASE

§ 711. It has frequently been pointed out—though not, perhaps, as frequently as the subject deserves—that ‘disease¹ . . . in actual practice refuses to conform to the hard and sharply-faceted categories of the ordinary text-book’ (Carter); and this seems to apply with peculiar force to the affections which have been termed pathological acarbonizing processes. It can hardly be disputed that most, if not all, of the various members of this large class tend to graduate imperceptibly, not only into each other, but into action which is purely physiological on the one hand, and, as we shall see later, into the manifestations of unrelieved hyperpyraemia on the other.

It has been argued that the physiological sense of satisfied hunger, depending, in part at least, upon physiological distension of the liver by glycogen, passes by insensible gradations into the anorexia of secondary dyspepsia, and this again into overtly pathological bilious attacks, affections which are both probably due to the same hepatic condition in extended degrees (§§ 72 to 81); and that such bilious attacks pass by insensible degrees into typical recurrent migraine (§ 292), the cranial and cerebral symptoms of which affection depend upon an exaggerated complexity of the common vaso-motor action, instrumental in the essential digestive revolt (§ 453).

If now we take the main clinical phenomena of migraine to include sensory, and especially visual, disturbances, followed

¹ ‘Modern Medical Theory and Practice,’ Carter, *Brit. Med. Journal*, November 3, 1900.

by headache and vomiting in that order, we shall find, on reviewing a number of histories, that any of these symptoms may be modified, displaced, or absent. The visual disturbances, instead of presenting hemianopia with spectral appearances, may be represented only by specks before the eyes, by dimness of vision, or simply by inability to read. Headache, in typical cases intense and unilateral, may be moderate and general; and a slight headache, associated with some impairment of appetite, may constitute the whole attack, as in the common variety of morning headache. Headache may not supervene until after the vomiting (Case VI); or it may be quite absent, when the vomiting may remain as the sole representative of the attack, as pointed out by Clifford Allbutt.¹ Cases such as the last would be indistinguishable from many of the cases described by Van Valzah,² Soltau Fenwick,³ and others, under the head of 'Periodic Vomiting.'

The vomiting may be absent, being represented by digestive phenomena in descending degrees of severity: such cases graduate down, as we have seen, into recurrent anorexia and dyspepsia. But in some cases the digestive phenomena are wholly absent: they may have been present originally and gradually subsided with advancing age, as remarked by Anstie; or they may have been absent from the beginning. Such cases graduate into, and become indistinguishable from, recurrent or periodic neuralgias, affections which we shall regard later as, in some cases, manifestations of unrelieved hyperpyraemia.

Again, migraine in children, as we have seen, may be associated with considerable pyrexia; and Chas. K. Mills says of juvenile migraine:—'At first, the attacks can scarcely be recognized as genuine sick-headache, pain not being prominent.' Consider pain as suppressed, and we have the symptom-complex described by Eustace Smith⁴ under the head of 'Recurrent Gastric Catarrh,' which, this author avers, may be febrile or non-febrile (§ 76). In febrile cases, the gastric symptoms may present all grades of severity: in some, they may be so toned down as not to rise above the degree common to practically all pyrexias; and in such, recurrent pyrexia or recurrent ephemeral fever would be a more appropriate term (§ 666).

¹ 'Gulstonian Lectures,' *Lancet*, vol. i. 1884, p. 508.

² *Diseases of the Stomach*, 1898, p. 329.

³ Clifford Allbutt's *System of Medicine*, vol. iii. p. 412.

⁴ *Lancet*, vol. ii. 1880, pp. 805, 847.

Migraine may pass into epilepsy: I have quoted Gowers (§ 504) in support of the existence of rare cases in which the symptoms of the two disorders are commingled. Similarly, headache, indistinguishable from some migrainous headaches, may precede, or be associated with, asthma (§ 502). And cases are recorded in which migraine and angina pectoris were similarly associated (§ 503).

§ 712. Epilepsy may graduate into many acarbonizing processes, other than migraine: we have seen it commingled with asthma (§ 506), and with angina pectoris (§ 507). The impossibility of distinguishing, in some cases, between a slight epileptic seizure and syncope is admitted; and if Goodhart¹ is correct in ascribing many swoons to peripheral vaso-motor spasm, then the distinctions between the two will become still less, if they do not disappear. In the following cases, the dependence of syncope upon peripheral vascular spasm seems to be demonstrated:—

A lady had suddenly lost her husband through virulent plague. She went into repeated syncope which finally became almost continuous. Her skin, especially of the extremities, was anaemic and cold. Her feet had been wrapped in hot flannels, and general frictions and alcohol had been administered without result. Dr. Hawkes then saw her, and found complete corneal anaesthesia. Amyl nitrite inhalation was given. Sixty seconds later, she spoke and then recovered. The syncope did not return. Since this case, Dr. Hawkes has had four others in all of which the drug acted with equal promptitude and satisfaction. In three of these, the syncope occurred in his consulting-room, and followed small intra-nasal operations. In one of these, the patient had had two previous intra-nasal operations, and on neither of these occasions was she able to leave the consulting-room for two or three hours. On the occasion on which amyl nitrite was used, she left within fifteen minutes.

Unless the syncope in these cases was due to inhibitory cardiac weakness *secondary to* peripheral spasm, I cannot see how we can explain the immediately beneficial effect of the drug.

§ 713. Donkin infers that night terrors in children are often epileptic manifestations; and the close association of epilepsy with mania and other varieties of insanity is admitted by most alienists. Dr. Thompson, physician to the Roosevelt Hospital,

¹ *Lancet*, December 21, 1901, p. 1715.

New York, points out that 'even¹ the loss or marked impairment of consciousness, hitherto considered as diagnostic of epilepsy, is not . . . a constant symptom.' He instances the case of a patient who during his epileptic attacks, became aphasic, but whose intelligence remained so clear that he made observations on himself while in this condition, and found that he could play the violin then as well as at other times. In such a highly exceptional case, the muscular movements would be fully under control: in others, they would be partially so, and exhibit more or less co-ordination. Hence cases are to be found which graduate imperceptibly into hystero-epilepsy, if not into mere hysteria. Gowers² in speaking of *severe hysteroid convulsions*, says:—'The frequency with which they are sequelae to *slight* epileptic seizures . . . is an extremely important fact.' (Italics mine.) Slight epileptic seizures would doubtless fail to secure efficient acarbonization; and their reinforcement by powerful hysteroid convulsions would be intelligible. Elsewhere, we shall see slight epileptic seizures similarly reinforced by acute maniacal attacks (§ 810). Infantile epilepsy, like infantile migraine and infantile asthma, may be associated with considerable pyrexia. Finally, epilepsy may graduate into conditions which can only be regarded as physiological: Haig³ believes 'there are really to be met with all gradations from a mere temporary absence of mind, up to a severe epileptic fit'; and herein my experience leads me to concur.

§ 714. Fully developed paroxysmal asthma may be taken as the type of recurrent respiratory pathological acarbonization. Instances of its gradation into other typical pathological acarbonizing processes (migraine, epilepsy) and into angina pectoris have just been referred to. But such instances are rare. Far commoner are the gradations of asthma into the other *respiratory* manifestations of hyperpyraemia. The vaso-dilation which, when affecting the smaller bronchial tubes, is productive of the typical asthmatic paroxysm, may affect other portions of the respiratory mucous membrane in varying extent. It may affect the Schneiderian membrane: this may occur as an immediate antecedent, or as a concomitant, of asthma;

¹ *Lancet*, December 13, 1902, pp. 1644, 1645.

² *Diseases of the Nervous System*, 1893, vol. ii. p. 1010.

³ *Uric Acid in Disease*, 1897, p. 241.

or it may occur independently. In either case, it will give rise to many of the signs of a common cold, if, indeed, it is not identical with some cases of that affection. Such signs (coryza, sneezing, etc.) may be so slight as to be barely noticeable; or they may be severe. In the latter case, they are capable of replacing an impending asthmatic attack (§ 657); or an impending attack of migraine (§ 657). Many women, we have seen, suffer from Schneiderian vaso-dilation at every menstrual period; and others who are subject to vaso-dilation of the asthmatic area suffer exacerbations at these times. The relations of asthma to acute bronchitis have been dwelt upon (§ 660); so also has the probability that recurrent bronchitis in children is a pyrexial modification of asthma; and later I shall argue that there exists an unbroken series of gradations between the most typical paroxysmal asthma and chronic bronchitis, an affection I propose to regard as a respiratory manifestation of unrelieved hyperpyraemia (§ 774).

§ 715. The graduation of acute gout into the other pathological acarbonizing processes which depend upon hyperpyraemia is perhaps most perceptible from a pathological standpoint. It is of course only in gout that uric acid deposition becomes the instrument of acarbonization. But this deposition is but the result of an exaggeration of the uricaemia which is common to all and which in all depends upon the same factor, namely, hyperpyraemia. Clinically, the manifestations of retrocedent gout, gastralgic and other, may perhaps be regarded as intermediate in nature between acute gout and the neurosal acarbonizing processes. The graduation of acute acarbonizing gout into chronic gout, to be regarded later as a manifestation of unrelieved hyperpyraemia and uricaemia, is clinically quite conspicuous, all intermediate varieties being met with. Its graduation in the direction of physiological conditions is also palpable: clinically, all modifications of the acute attack are encountered down to the slight articular pricking sensations which, in some persons, habitually follow the ingestion of liquors, such as strong beer, port wine, and champagne; and, pathologically considered, the uric acid accumulation, the proximate factor of the gouty attack, is but an exaggeration of a physiological condition (§ 631).

§ 716. Angina pectoris, ‘sometimes¹ . . . perfectly inde-

¹ *Clinical Medicine*, New Syd. Soc., Trousseau, vol. i. p. 634.

pendent of all organic lesion of the central organ of circulation' (Trousseau), may be dependent, as has been argued, upon hyperpyraemia, and be anatomically due to vaso-dilation of the coronary area. Such vaso-dilation, doubtless in much slighter degree, is the physiological condition inseparable from severe physical exercise; and the sensory manifestations of angina may present themselves in every grade of severity, from a frightful suffocative breast pang down to the slight retro-sternal uneasiness, with moderate sense of breathlessness and constriction, which is the normal concomitant of violent exercise in all who are not in good physical training. The proximate causes of frank angina are the proximate causes of the modified physiological representatives. Violent exertion, more especially violent sudden exertion, may lead to either: such are particularly powerful soon after a heavy meal, when distension of the stomach tends to decrease the working efficiency of the heart and when there is a sudden increase in the carbon contents of the blood. And sudden exposure of the chest to cold air or water may cause an excellent imitation of the anginal pain in those who never suffer such symptoms under other circumstances: the writer has had such experiences on more than one occasion. Here again the recent ingestion of a meal is an important co-operating factor.

§ 717. Raynaud's disease, another probable manifestation of hyperpyraemia, presents palpable gradations. Local syncope may be regarded as an intensified and specialized variety of the physiological cutaneous anaemia due to exposure to cold. Physiological cutaneous anaemia is apt to be followed by reactionary cutaneous hyperaemia: such hyperaemia graduates insensibly into chilblains; and chilblains into Raynaud's local asphyxia. Parenthetically, it may be stated that no condition is more amenable to dietetic and hygienic management than chilblains in children: they seem to be almost invariably associated with a deficiency of proteid and a deficiency of exercise.

§ 718. The gradations between insanity and other conditions, physiological and pathological, are easily perceptible. Tilt says: '—If the reader will recall the results of his own experience, he will own:—1. That between haziness of intellect and the temporary loss of mental power and idiocy there is no

¹ *Change of Life*, 1882, pp. 205, 206.

break. . . . 2. That between the first slight estrangement of a girl's temper and the maniac's frenzy there is no break. . . . 3. That between the first indications of spontaneous muscular action called "the fidgets" and the strongest convulsions of hysteria there is no break.'

The gradations of disease might, I think, be followed almost indefinitely: as evidence of this tendency, all the less common and less understood manifestations of vaso-motor action might be adduced; and it might be shown that they present infinite variability and tend to graduate in all directions, (1) into each other, (2) into action which is admittedly physiological, (3) into chronic or persistent, and (4) finally into degenerative, disease. But enough has now been said to illustrate the principle.

ALTERNATIVE SYSTEMS OF CLASSIFICATION

§ 719. We may be fully imbued with the importance and significance of the gradations between physiological and pathological action, and between the various forms of pathological action, and yet be unable to deny that the accepted terminology, originating as it has done in prolonged and accurate clinical and anatomical observation, more or less divorced from theoretical speculation, is, generally speaking, truly representative of the most conspicuous types of disease. It would be inexpedient, therefore, to discard terms in current use; and their retention will serve to avert the necessity for profuse definition. Even so, however, the classification of the pathological acarbonizing processes depending upon hyperpyraemia is yet to make; and it must be apparent that, for the present, such must remain largely provisional and therefore optional.

Darwin insists that a natural system of classification in biology must be, as far as possible, based upon descent. In considering disease, descent may be translated into causation; and a classification in which the numerous factors of disease took precedence in the order of their relative etiological importance would approach nearly to the ideal, in that it would be a classification on real affinity and not on mere superficialities.

Now the primary factor of the pathological acarbonizing processes which depend upon hyperpyraemia (which are not merely incidental, that is to say) must be regarded, in most cases, as hyperpyraemia; but in all cases there must be

numerous secondary factors—factors, for example, which determine the form of the pathological action and the exact time of its occurrence, or both. Such secondary factors may be internal only or external as well as internal: they may be proximate or remote, and conveniently regarded as exciting or merely predisposing; and we might accept such distinctions as a primary basis of classification.

But in comparison with the profusion and complexity of these secondary factors, embracing as they do hereditary and acquired tendencies and structural peculiarities as well as the ever-varying factors in an ever-varying civilized environment, our knowledge must be regarded as infinitesimal. A concrete example may render this clearer. In some pathological acarbonizing processes, such as hay-asthma, there can be no doubt of the existence of a proximate external exciting cause; while in others, such as typical periodic migraine and asthma, it is at first sight reasonable to suppose that such is not the case. But when we realize the influence of eye-strain in some typical cases of migraine, and of slight atmospheric alterations in some typical asthmas, it is impossible for us to deny with any confidence that such excitants enter to some extent into all migraines and all asthmas. Hence a classification so based could hardly approach finality. It would be disadvantageous, moreover, on other grounds: especially, it would tend to obscure both the mechanism and the modes of action of the various processes, through the formation of groups, heterogeneous in most respects save that of causation.

Again classification might be based upon the mechanism of the various processes and follow more or less anatomical lines. We might divide the whole class into nervous, pyrexial, etc.: subdividing the first into vaso-motor (migraine, asthma, etc.), vaso-motor + cardio-inhibitory (some epilepsies), vaso-motor paresis (glycosuria ?), etc.: the second, in various ways, perhaps guided by the proximate factor of the pyrexia, as, for example, uric acid in acute gout, and so on. Such a classification would have the advantage over the first of conforming more with existing classifications.

THE ADOPTED SYSTEM OF CLASSIFICATION

§ 720. But I am inclined to think that the best system of classification at present available is one based primarily upon

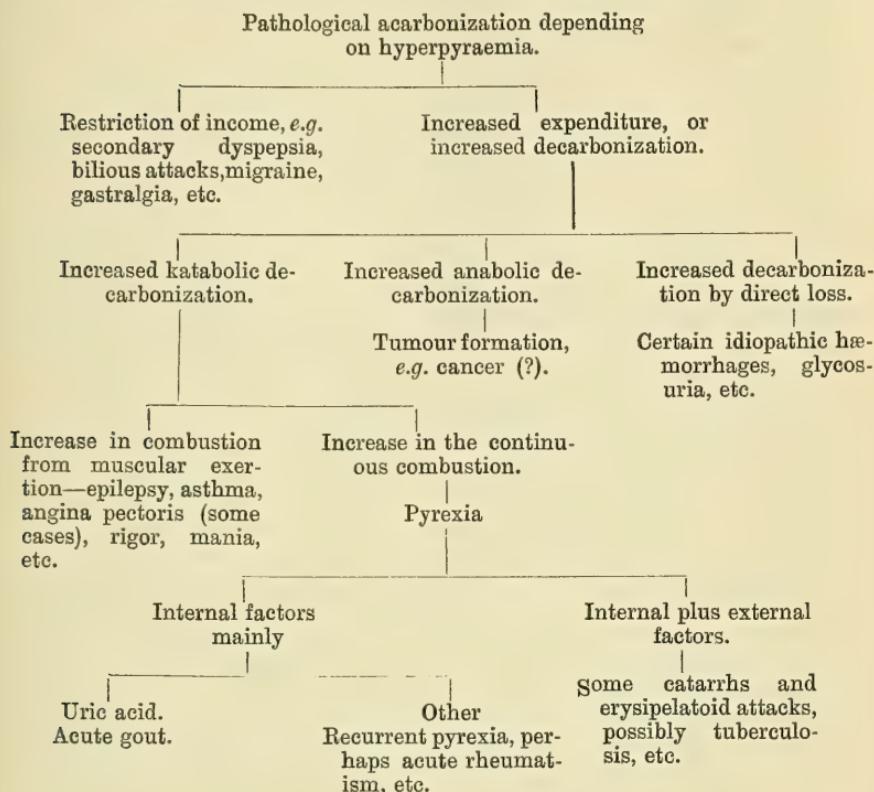
the mode in which acarbonization is effected. This will conform, more nearly than any other, with the classification of physiological acarbonization. Pathological acarbonization, like its physiological analogue, is achieved in two fundamentally different ways, namely by restriction of income and by increase of expenditure. Under restriction of income, we may place such affections as secondary dyspepsia, bilious attacks, migraine, and gastralgia. Increased expenditure, we may divide in accordance with the nature of the expenditure, into increased katabolic decarbonization, increased anabolic decarbonization, and increased decarbonization through direct loss. Increased katabolic decarbonization may be subdivided, according as the increased combustion results from increased muscular exertion (major epilepsy, asthma, mania, etc.), or consists simply of an increase of the subdued continuous combustion, which is ever present during life in the resting muscles and other tissues of the body (pyrexia) : increased anabolic decarbonization would include the formation of tumours, such as cancer, in the event of its becoming demonstrable that such may depend upon hyperpyraemia; increased decarbonization by direct loss would include certain forms of 'idiopathic' haemorrhage, such as recurrent epistaxis, haemorrhage from piles, glycosuria, etc. Further subdivisions might be made in accordance with the proximate factors of the processes : for example, pyrexia might be classified according as it depended upon internal factors only (gout, recurrent pyrexia of childhood, etc.), or on internal plus external factors (some catarrhs, and erysipelatoid affections, perhaps tuberculosis, etc.)

§ 721. The subjoined table gives a comprehensive view of such a system of classification.

The classification adopted is by no means perfect ; and its imperfections depend mainly upon the principle of the gradations of disease : so also, probably in even greater degree, would the imperfections of the alternative systems proposed and rejected. These almost interminable gradations lead of necessity to overlapping in all directions. For example, I have classified bilious attacks, migraine, and gastralgia as processes which operate by restriction of income. But this is not true exclusively. All three affections may be associated with violent vomiting, and this necessarily would increase expenditure materially through increased muscular exertion ; and the first

TABLE VI.

CLASSIFICATION OF THE PATHOLOGICAL ACARBONIZING PROCESSES DEPENDING ON HYPERPYRAEMIA



two, at least, may, especially in children, be associated with marked pyrexia, a sign probably of increased combustion. Again, I have classified asthma and epilepsy as processes which operate by increasing muscular exertion and so combustion or katabolic decarbonization ; but asthma and convulsions may be associated with pyrexia in children, and both affections may be preceded by, and associated with, digestive disturbances which more or less restrict the carbonaceous income. Finally, pyrexia of any kind depends in the majority of cases, for its acarbonizing influence, largely upon loss of appetite, impaired digestion, and restricted absorption, as well as upon exaggerated combustion.

CHAPTER XIX

§§ 722–769

Unrelieved hyperpyraemia: definition—Vascular manifestations: persistent high blood-pressure: food: exercise: external temperature and climate: diseases leading to retarded combustion: rhythmic fluctuations in the carbon contents of the blood: pregnancy: fat-formation: pyrexia: gout: haemorrhage: glycosuria: constipation and purgation: plumbism: paroxysmal neuroses: pathological anabolism: negative factors in persistent high blood-pressure: summary of evidence and conclusions—Mechanism of persistent high blood-pressure—Relation of blood-pressure to urinary excretion: water: water and uric acid: water, uric acid, and urea—Summary.

§ 722. In Chapter VII, I have argued that hyperpyraemia arises through an imperfection in the balance between the carbonaceous income and the carbonaceous expenditure of the blood, whereby the former exceeds the latter—in other words, that hyperpyraemia depends upon a relative inadequacy of physiological acarbonization. In the succeeding chapters, I have argued that pathological acarbonization frequently comes to the aid of, and reinforces, inadequate physiological acarbonization; and that such auxiliary acarbonization may be incidental, that is, dependent upon factors other than hyperpyraemia, or adaptive, that is, dependent on the hyperpyraemia.

But hyperpyraemia does not always institute pathological acarbonization, and incidental acarbonization is not of course to be depended upon. Hence in the absence or inadequacy of all pathological acarbonization, the underlying blood-state may be regarded as one of unrelieved hyperpyraemia. Thus the manifestations of unrelieved hyperpyraemia will embrace all the manifestations of hyperpyraemia, other than the pathological acarbonizing processes which depend upon hyperpyraemia. Obviously the class of affections so included will be extensive and clinically heterogeneous.

In this class we shall have to include several affections

already considered for convenience in other connexions. Glycogenic distension of the liver has been regarded as an index of high carbon contents of the blood, pathological distension of the liver by glycogen as an index of hyperpyraemia; and chronic pathological distension of the liver by glycogen, inasmuch as it has failed to institute acarbonizing processes, such as bilious attacks and migraine, must now be regarded as a manifestation of unrelieved hyperpyraemia (§ 95).

Angina pectoris, inasmuch as it cannot in many cases be considered an efficient acarbonizing process, must often be regarded as a manifestation of unrelieved hyperpyraemia; and so, for the same reason, must many other vaso-motor affections, such for example as Raynaud's disease, some neuralgias, and many atypical disorders.

§ 723. The idea has often been voiced that the phenomena of any of the fully developed typical paroxysmal neuroses may be broken up and isolated from one another, appearing singly or in groups of various combinations, at different times in the same individual, or in different individuals; and many of the atypical hyperpyraemic disorders just referred to may be explained on this hypothesis. Thus an epileptic subject may suffer at times from sensory aurae only, from mental conditions such as sudden causeless sense of fear, or from slight clonic convulsions. Such convulsions may affect a single muscle or a few fibres of a muscle, without other symptoms of a fit: they may even consist of a single spasm. These phenomena cover the whole list of the manifestations of minor epilepsy detailed by Gowers,¹ together with others to which he does not allude. Thus we have the authority of Donkin for the opinion that night terrors, habitual somniloquence, and somnambulism are 'often co-existent with and indicative of epilepsy'² in children.

A migraine patient may suffer from headache without gastric disturbance, or from slight gastric disturbance without headache: he may suffer from transient hemianopia, vertigo, tinnitus, and other isolated nervous disturbances.

An asthma patient may suffer, concurrently with his asthmatic paroxysm, from the effects of vaso-dilation affecting the nasal, faacial, pharyngeal, laryngeal, and tracheal mucosae; but any of these may be detached from the major paroxysm

¹ *Diseases of the Nervous System*, 1893, vol. ii. p. 745.

² *Diseases of Childhood*, 1893, p. 240.

and affect him during interparoxysmal periods ; and they may all be occasional, or graduate into chronicity.

All these and numerous other detached representatives of the paroxysmal neuroses may occur in persons who have never suffered from the fully developed affections. A medical friend of mine has in past years, when apparently in good general health, experienced a long list of these minor ‘nervous’ manifestations. Among them were a sense of glimmering before the eyes, with motile black specks : hemianopia (horizontal) : electriform starts on commencing to go to sleep, sometimes preceded by aurae of various kinds : sudden momentary arrest of the heart’s action, followed by palpitation : motor disorders of speech, such as slight transient spasm of the tongue and muscles of the face : occasional twitchings of the muscles of the trunk and extremities : sensory disturbances such as formication ; and slight vaso-motor cutaneous disorders, such as pallor and flushing in unusual places. And his experience is by no means exceptional. It is true such experiences are rarely brought under the notice of the physician, except by self-centred hypochondriacs or hysterical persons, the more healthily constituted regarding them as normal, or of trifling import. But careful enquiry will show that a large proportion of seemingly healthy people are thus affected.

§ 724. Many such symptoms are vaguely ascribed to ‘liver,’ and there is no doubt that they are often associated with the glycogenic distension of that organ which, I have argued, is so common a manifestation of hyperpyraemia. Their fundamental dependence upon hyperpyraemia is evidenced by the ease with which they may usually be dispersed by agencies, physiological, pathological, or therapeutic, which acarbonize the blood. Thus physical exercise, cold weather, increased fat-formation, dietetic treatment by restriction of the carbonaceous food-stuffs, even vegetarianism, may all be effectual in different cases ; and a formal acarbonizing paroxysm of any sort (biliary attack, migraine, asthma, epilepsy, gout, etc.) not infrequently confers immunity for considerable periods from all the minor troubles enumerated.

Of course it may be that the degree of hyperpyraemia responsible for these minor troubles is but slight, and that a higher degree would precipitate effectual pathological acarbonization ; but even so, since they cannot be considered

acarbonizing processes, the minor troubles may be regarded as manifestations of unrelieved hyperpyraemia. In this sense, all pathological acarbonizing processes depending on hyperpyraemia would be preceded by a period of unrelieved hyperpyraemia.

But, in other cases, a high degree of hyperpyraemia may exist without entailing pathological acarbonization. Here, at any rate, the absence of pathological acarbonization may be ascribed to inability on the part of the organism to institute such conservative measures, and not to an inadequate degree of hyperpyraemia; and the hyperpyraemia may be regarded as more or less persistent. Hence in the complete etiology of unrelieved hyperpyraemia we must include a long list of negative factors—an absence or inadequacy of pathological acarbonization of all kinds.

§ 725. In the case of the paroxysmal neuroses, we arrived at the conclusion that, in many cases, there are in operation secondary factors which render the paroxysms exceptionally facile of development: that in such, some one form of neurosal acarbonization is apt to become prepotent over physiological acarbonization; and that when this happens, the hyperpyraemia constituting the humoral factor is to be regarded as relative only (§§ 511 to 513). A similar argument might have been extended to some of the pathological acarbonizing processes, other than the paroxysmal neuroses; and the same may now be extended to many of the manifestations of unrelieved hyperpyraemia. In all cases coming under this head, there are in operation numerous factors, other than the condition of the blood,—factors which determine the manifestations peculiar to each case; and such factors may be so potent as to determine hyperpyraemic manifestations in the presence of a pyraemic condition which would otherwise be normal. In these cases, the condition of unrelieved hyperpyraemia is relative only: the carbon contents of the blood are normal for the system at large, excessive only for the special system, organ, or tissue which is the site of the morbid manifestation. Hence it not infrequently occurs that clinical phenomena which I shall class as manifestations of unrelieved hyperpyraemia coexist with a perfectly physiological condition of the organism generally. The fact that a relative hyperpyraemia enters into the causation of such manifestations may frequently be

demonstrated by the curative influence of reduction of the carbonaceous intake; nor is the demonstration rendered the less conclusive by the fact that sometimes, under this treatment, the general health and strength suffer to some extent concurrently with the relief of the special affection. Perhaps the best illustration of this argument is seen in some cases of acne. During adolescence, there is often an extremely strong proclivity to this unsightly disorder; and, in several cases, I have succeeded in curing it temporarily by simply cutting down the carbonaceous intake. But, in one of these, the degree of dietetic restriction demanded for this purpose left the carbonaceous intake manifestly insufficient for the due maintenance of nutrition.

§ 726. As with the pathological acarbonizing processes depending on hyperpyraemia, so with the manifestations of unrelieved hyperpyraemia, some depend, probably, more or less directly upon the humoral condition itself: others depend proximately upon the secondary vaso-motor action; and others, again, proximately upon the secondary distension of the liver to a pathological degree by glycogen. But there is another condition which, in physiological degree, is secondary to physiological high pyraemia, namely deposition of muscle-glycogen (§§ 122 and 123); and it becomes a question whether a pathological degree of deposition of muscle glycogen may not, in some cases, be secondary to hyperpyraemia and be the proximate factor of some of the manifestations of unrelieved hyperpyraemia. The supposition cannot of course be proved, but I am inclined to believe it to be true. Take for example the following case—a case typical of many which are met with every day in general practice:—

A stout elderly man of business, a hearty eater and fond of supper, according to his own account had never had a day's illness in his life. Two years ago he began to suffer from pain in the muscles of the small of his back. At first the pain began on awaking in the morning: later it awoke him early in the morning; and later still it awoke him an hour or so after he went to bed and kept him awake for much of the remainder of the night. But first and last, the pain invariably passed off when he got up and began to move about. I cut off his sugar, of which he was very fond: directed that his last meal at 6.30 P.M. should consist mainly of proteid and green non-starchy vegetables: precluded eating thereafter and enjoined a short walk

just before bedtime. On the first night after the commencement of this treatment, he slept till 5 A.M., when he awoke with a little back-ache : on the second he did not awake until 7 A.M. ; and on the third morning he was late for breakfast. On neither the second nor the third morning did he have any pain, nor has he had any since.

In this case, I do not think there can be any doubt that the affection was hyperpyraemic ; and it seems reasonable to connect the muscular pain with an exaggerated deposition of muscle glycogen. We must, however, consider the possibility of extravascular deposition of uric acid in the muscle sheaths and other fibrous structures.

I have suggested the probability that the hyperpyraemia which antecedes the infrequent acarbonization of acute arthritic gout is more complex in its chemical constitution than the hyperpyraemia which antecedes the more frequently recurring acarbonization of the paroxysmal neuroses (§ 196). The same may be argued to apply, perhaps in even greater degree, to many of the manifestations of unrelieved hyperpyraemia : it is possible that the compounds, which constitute the hyperpyraemic load in these cases, are even more complex than in acute arthritic gout.

VASCULAR MANIFESTATIONS: PERSISTENT HIGH BLOOD-PRESSURE

§ 727. Under this head it will be convenient to consider, not only the pathological condition of persistent high blood-pressure, but also some points in connexion with high blood-pressure generally, temporary and recurrent as well as persistent, physiological as well as pathological.

Extensive vaso-constriction is, as we have seen, a common feature in the paroxysmal neuroses ; and the tendency to high general blood-pressure, so induced, may be abrogated in two ways, namely, by vaso-dilation in other areas or by modifications of the heart-beat. Frequently, however, it would appear, compensation is inadequate, and then there is an actual rise of blood-pressure during the continuance of the paroxysm. But the rise of blood-pressure is not always limited to the paroxysms. Broadbent says :¹—‘ Migraine or sick-headache . . . is, according to my experience, almost always associated with high tension,

¹ *The Pulse*, 1890, p. 177.

not only during the attacks, but as an habitual condition.' All the other paroxysmal neuroses and gout may be similarly associated. Now, having agreed that all these affections may depend upon hyperpyraemia, we might feel justified in ascribing the rise of blood-pressure, continuous as well as paroxysmal, directly to the same blood-state. But such an argument would be widely open to criticism: it might be objected that the paroxysmal form of high blood-pressure, at least, is purely nervous, and that it is not now generally admitted that the well-known condition of persistent high blood-pressure is even mainly nervous in its mechanism. On these and on other grounds, it will be safer to consider persistent high blood-pressure independently.

Modern physicians are wont to assume that the impurity of the blood responsible for high blood-pressure depends on some waste nitrogenous material. One states that the products of imperfectly oxidized nitrogenous waste irritate the arterio-capillary system and so lead to continuous high blood-pressure. Another considers that the special material responsible for persistent high blood-pressure is certainly some nitrogenous waste which has not undergone the complete oxidation necessary for elimination. This he admits is difficult to prove; but he suggests that, just as carbonic acid retained in the blood gives rise to extremely high blood-pressure, so retained excretory matters of another kind may have a similar effect. He points out that in gout and renal disease high blood-pressure is marked, and that in both there is certainly contamination of the blood by the products of imperfect metabolism; and further, that eliminative treatment is highly successful in reducing high blood-pressure.

Now the whole of this argument goes to show that in persistent high blood-pressure there is a retention in the blood of imperfectly oxidized material: none of it, so far as I can see, goes to show that such retained material is nitrogenous. If retention of carbonic acid in the blood is the cause of the high blood-pressure of asphyxia, that would tend to show, if anything, that the retained material in high blood-pressure cases generally is carbonaceous. It has been argued that in gout the *primary* retention consists of carbonaceous, not nitrogenous, material; and later I shall argue that the same is true of chronic renal disease. Moreover we shall see that the eliminants most

efficacious against high blood-pressure are those which increase the output of carbon rather than of nitrogen; and I have given *a priori* reasons against the probability of a retention of nitrogenous material within the organism as a primary step in disease (§ 11).

The hypothesis that persistent high blood-pressure may be an expression of unrelieved hyperpyraemia can be supported by a large amount of circumstantial evidence.

§ 728. Food.—George Oliver¹ has made ‘hourly observations of the mean arterial pressure throughout the day from 8.30 A.M. to 10.30 P.M. in a subject leading an ordinary quiescent life with comparative rest of the muscles.’ The record so obtained shows ‘that² the pressure follows a rhythmical course, that there is a marked rise immediately after each meal, which attains its maximum development in an hour, and that then the pressure slowly subsides. This wave-like rise and fall of the arterial pressure produced by each meal lasts from two and a half to four hours. . . . The amplitude and length of the curve are, as a rule, proportionate to the size of the meal. The observations show that the average maximum rise of the mean arterial pressure attained in an hour after a meal amounts to 15 millimetres of mercury, though it may reach 20 millimetres; for example, a typically normal wave should rise from 100 to 115 millimetres and then gradually return to 100 millimetres.’ As to the mechanism of this post-prandial rise of blood-pressure, this author shows by arteriometer observations that it is in part due to peripheral constriction of the systemic arterioles, and in part to increase of cardiac action. These two factors together are more than sufficient to compensate for the large splanchnic vaso-dilation which occurs during digestion. The peripheral vaso-constriction has been noticed by Foxwell³ also, who says:—‘It is quite a common experience to note the radial artery grow small and hard some three or four hours after an unwholesome meal.’ On the theory of hyperpyraemia, the fundamental humoral factor of the rise of blood-pressure is the entrance of carbonaceous material into the systemic circulation; and all the above observations are entirely consistent with this view.

James Mackenzie⁴ points out that the recurrent high

¹ *Lancet*, June 13, 1903, p. 1643.

² *Ib.*

³ *Essays in Heart and Lung Disease*, Arthur Foxwell, 1895, p. 23.

⁴ *The Study of the Pulse*, 1902, p. 72.

blood-pressure which sometimes affects persons after middle life not uncommonly comes on ‘after some prolonged course of over-feeding.’

§ 729. The commonly accepted dietetic treatment for high blood-pressure is a large reduction in the amount of proteid. Broadbent says: ¹—‘In all cases of abnormal tension in the arteries, the amount of highly nitrogenized articles of diet should be limited to a minimum compatible with the health and vigour of the individual.’ The reduction of proteid so implied may result in a reduction of the carbonizing capacities of the digestive organs as already argued (§ 246): thus the carbonaceous income to the blood will be restricted, and this may result in dispersion of hyperpyraemia and high blood-pressure. But this does not always occur. Broadbent says: ²—‘In many instances, the reduction in the amount of nitrogenized food has little effect on the presence of imperfectly oxidized matters in the blood —there is no reduction in the blood-pressure, that is to say. According to this argument, such therapeutic failures are accounted for by a concurrent reduction in the decarbonizing capacities (katabolic, anabolic, haemorrhagic) of the tissues, which is proportionate, or more than proportionate, to the reduction in the carbonizing capacities of the digestive organs (§ 249). In these cases, Broadbent often finds it necessary to ‘cut ³ off all meat and feed the patient chiefly on milk.’ In my experience it is even better to feed the patient *solely* on milk; and herein I do not stand alone. Many authors have noted the beneficial influence of a milk diet upon conditions, such as lithaemia, which are commonly associated with high blood-pressure; but H. C. Wood says: ⁴—‘To get the peculiar full effects of a milk diet, it is essential that the patient abstain, at least for a time, from all other food.’ And Sydenham,⁵ speaking of a milk diet for gouty patients, said:—‘It has done more good to many than any other kind of remedy for this disease *as long as they kept exactly to it.*’ (Italics mine.) Now milk—cow’s milk more than human milk—regarded as a complete diet is highly nitrogenous and lowly carbonaceous, probably more highly nitrogenous and more lowly carbonaceous than any other

¹ *The Pulse*, 1890, p. 179.

² *Ib.* p. 180.

³ *Ib.* p. 301.

⁴ *Therapeutics: its Principles and Practice*, 1888, p. 54.

⁵ Quoted by J. M. Fothergill, *Gout in its Protean Aspects*, 1883, p. 225.

complete diet we are accustomed to prescribe, with the exception, of course, of one consisting of lean meat exclusively; and this is especially true when, as is so commonly done in the disorders under consideration, the milk is administered partially skimmed. Probably, therefore, we shall not err if we ascribe the reduction of general blood-pressure which follows a milk diet to the reduction of the carbonaceous intake so assured.

§ 730. Broadbent says that amongst the most frequent and important of the symptoms attending high blood-pressure are 'headache,¹ sleeplessness, breathlessness, depression: loss of energy, resolution, memory, and nerve: giddiness, a sense of fulness in the head, pain and oppression in the chest, and neuralgia.' He admits it is not easy to say whether these symptoms depend upon the vascular condition, or upon the blood-state responsible for the vascular condition.² For my own part, I am strongly inclined to ascribe them, in the main at least and in most cases, to hyperpyraemia; for I am sure I have seen the majority of them in hyperpyraemic conditions, unassociated with any marked degree of general high blood-pressure. But, be that as it may, I have frequently succeeded in dispersing the whole train of these symptoms, and concurrently attained a distinct reduction in the general blood-pressure, by a hygienic and dietetic line of treatment designed to promote acarbonization of the blood.

Finally, I have no doubt from my own observations and those of several others, that a small purely proteid diet, strictly enjoined for a short period, is capable of rapidly reducing pathological high blood-pressure in some cases. It must be admitted, however, that the use of a lean meat diet in these circumstances would not be free from the danger of inducing an attack of arthritic gout. A purin-free proteid would be the ideal.

§ 731. EXERCISE.—The influence of muscular exercise on blood-pressure is complex. Leonard Hill says:³ 'Violent exercise raises the tension by 20 mm. Hg: this rise lasts for some fifteen minutes and is followed by a fall.' These variations are thus explained by Clifford Allbutt.⁴ 'The first effect of a general contraction of the muscular system must be to

¹ *The Pulse*, 1890, p. 176.

² *Ib.*

³ *Text-book of Physiology*, Schäfer, vol. ii. p. 80.

⁴ *System of Medicine*, vol. v. p. 846.

compress the veins embedded therein and thus at first to raise the blood-pressure to a degree answering to a partial closure of this vast area of the circulation. Marey demonstrated with the sphygmograph that even to throw the muscles of the legs into spasm (while breathing freely) raised the arterial pressure considerably. But in the next place, such is the exquisite provision of Nature, the blood-vessels . . . dilate, and reopening the vascular area which was momentarily constricted, they flood the muscles anew with arterial blood; thus at once the muscles are fed for the work and the peripheral resistance is lowered. This afflux is independent of the general arterial blood-pressure. Even under passive exercise also (massage), as Mitchell, Brunton, Tunnicliffe, and others have shown (vol. i. p. 378), the flow of blood through voluntary muscles becomes more abundant; and thus blood-pressure is reduced. . . . To this compensatory mechanism we must add, in most cases, an increased circulation in the cutaneous area and sweating, as we see in the major epilepsy.' The magnitude of the muscular vaso-dilation associated with physical exercise is thus estimated by Lauder Brunton.¹ 'The vessels which supply the muscles of the body and limbs are capable of such extension that, when fully dilated, they will allow the arterial blood to pour through them alone nearly as quickly as it usually does through the vessels of the skin, intestine, and muscles together.'

§ 732. But the fall of blood-pressure is much too enduring to be thus fully accounted for: it is maintained throughout the period of subsequent rest, long after the muscles and skin have ceased to be hyperaemic. Giving his personal experience, Clifford Allbutt says:²—'Alpine climbing and in later life cycling have always been followed by a fall of blood-pressure . . . for the rest of the day and night at any rate the pulse is soft and dicrotic.' Further, habitual muscular exercise tends to habitual low blood-pressure, and habitual sedentariness to habitual high blood-pressure. Clifford Allbutt says:³—'On the one hand I note that the blood-pressure of athletes runs a little lower than the average, on the other hand I note that the blood-pressure of men who lead sedentary lives, without denying themselves a like abundance of food, often runs high. I venture to think from some little experience that in members

¹ *Harveian Oration, 1894.*

² *System of Medicine, vol. v. p. 844.*

³ *Ib. p. 845.*

of a university or of the learned professions the blood-pressure tends to rise as athletic habits are laid aside.' Of himself he says :¹—' If, on account of bad weather, I cannot take sufficient exercise, my pulse gives me the sense of higher pressure, and I am conscious of a falling off in vigour and temper.'

As to the treatment of persistent high blood-pressure, there seems little difference of opinion. Broadbent says :²—' Exercise and fresh air are of primary importance . . . and a persistent neglect of these essentials to health will defeat any attempt to rectify permanently a tendency to high pressure in the arterial system.' Clifford Allbutt says :³—' If, as I believe, one main cause of rising arterial pressure in middle life is excess of feeding—that is to say, of food in excess of work and excretion—the remedy obviously lies in prevention . . . in most persons as life slows down the *powers of expenditure fall within much narrower limits*. The ordinary man must be warned—say as he passes the age of 40 years—to keep up muscular exercise in the open air, and to control his appetite. *Many, I should say most, men eat and drink far more than they need for the day's work*; they are supplied with food generously without hunting for it; and annual blood-letting has gone out of fashion. As soon as high pressure becomes manifest, rigorous diet, deobstruent remedies, and exercise, such as cautious hill-climbing under the careful regulation of the physician, are necessary, and necessary not only during a Homburg month and its "after-cure," but also for the rest of the patient's life. Catch him early and he is quite curable: let him drift and cure may be out of reach.' (Italics mine.)

The admitted value of the above-sketched hygienic treatment is fully explicable only on the view that persistent high blood-pressure depends upon hyperpyraemia. As already argued, the decarbonizing capacities of the tissues tend to wane as life advances (§ 231): as we have seen, physical exercise, which does not materially increase the total nitrogenous output (§ 6), is a great natural decarbonizing agent (§ 14); and a restricted diet, whether it operates on function or supply, or on both, reduces the carbonization of the blood.

§ 733. EXTERNAL TEMPERATURE AND CLIMATE.—We have seen that exposure to cold causes increased combustion and

¹ *System of Medicine*, vol. v. p. 844.

² *The Pulse*, 1890, p. 179.

³ *Lancet*, March 7, 1903, p. 649.

expenditure of carbon (§ 15); and it has been argued that, after eliminating combustion incited by the necessity for decarbonization, exposure to heat will be followed by the opposite results (§ 108). I cannot find, in any published writings to which I have access, any direct evidence that a spell of cold weather, or a trip to a cool climate, has a modifying influence upon persistent pathological high blood-pressure. But innumerable observations could be quoted to show that most of the symptoms which Broadbent ascribes to this condition (§ 730) are capable of being dispersed in this way; and I have myself seen several cases in which a change of residence from the tropics to a cool climate has reduced to within physiological limits permanently (as far as could be seen) a previously persistent high blood-pressure. It must be admitted, however, that the problem is no simple one: it is usually impossible, for example, to differentiate between the influence of lower external temperature and that of the increase of muscular exercise incited thereby, since the two almost invariably concur. Such differentiation would be easy only in the case of a high-tension patient who is precluded from muscular exercise by some physical disability which does not otherwise affect the general health. Further, it must be admitted that, in some cases, no benefit has accrued from the above-mentioned climatic change. It is unfortunate in this connexion that the decarbonizing influence of cold weather is apt to be associated with a disproportionately increased appetite and intake, and a consequent disproportionately increased carbonization of the blood.

The influence of prolonged external heat upon blood-pressure is clearly perceived by Broadbent. This author says:¹—
'I have been greatly struck with the frequency and degree of high arterial tension met with in Englishmen returning from India and other hot climates, but especially from the West Indies. My preconceived idea was that the external heat and free perspiration would produce general vascular relaxation; but observation has shown the exact contrary of this.' Of old residents of India, Surgeon-Lieutenant-Colonel Crombie says² that those who live well are very subject to high blood-tension.

The preconviction that it is the nitrogenous material which alone is capable of accumulating in the blood has led us to blame the meat-eating habits of Englishmen in the tropics for

¹ *The Pulse*, 1890, p. 162.

² *Lancet*, December 14, 1901, p. 1671.

the frequency of high blood-pressure. And, doubtless, in many cases a large excision of proteid from the ordinary mixed diet would, as already argued (§ 729), render this circulatory condition less frequent everywhere. But this proves, rather than disproves, the responsibility of hyperpyraemia. It is urged that, as there is but little need for combustion in the tropics, nitrogenized food is imperfectly burned off and eliminated. But this argument applies with much greater force (if not exclusively) to the carbon, than to the nitrogen, contents of the blood ; for, as we have seen, external temperature, which so greatly increases the output of the former, has little, if any, influence upon that of the latter (§§ 14 and 6).

§ 734. DISEASES LEADING TO RETARDED COMBUSTION.—Pathological conditions which are capable of retarding combustion are often associated with abnormally high arterial tension. *Anaemia* is capable of retarding combustion through decreased oxygen-carrying capacity of the red blood-corpuscles ; and Broadbent says of anaemia :¹ ‘It is a matter of daily observation that the artery is full between the beats, and that the pulse, if more abrupt than in renal disease, is long. . . . While high tension is the rule among anaemic patients seen in the consulting-room and in the London practice generally, exceptions are met with, and in agricultural districts, where little animal food is consumed, low vascular tension is very common.’ On the view that high arterial tension may indicate hyperpyraemia, its preponderating frequency amongst cases of anaemia is readily understood. Conditions such as insufficient proteid are palpably capable of reducing the carbonizing functions of the digestive organs as well as, and in proportion to, the decarbonizing functions of the tissues. But this is not necessarily true of a deficiency of haemoglobin, which, by reducing the supply of oxygen to the tissues, will probably reduce the function of oxidation or combustion (katabolic decarbonization) in greater degree than the functions of digestion, absorption, and anabolism, into which oxygen does not seem to enter, at any rate directly. The low pressure in some cases of anaemia, amongst the more or less vegetarian agricultural population referred to by Broadbent, would be explicable on the hypothesis that deficient proteid reduced

¹ *The Pulse*, 1890, p.

commensurately the carbonizing and decarbonizing capacities of the organism and so precluded hyperpyraemia.

Some chronic pulmonary diseases are probably associated with a tendency to retarded combustion, through diminished oxygen intake; and Broadbent says:¹—‘In cases of emphysema and chronic bronchitis, and sometimes even in phthisis, the systemic arteries present the signs of increased tension: in emphysema, they are especially marked.’ The suggested relation is doubtless true in many cases, but in some I am inclined to regard the lung disease and the high arterial pressure, not so much as cause and effect, but as conjoint manifestations of unrelieved hyperpyraemia (see Chapter XX).

§ 735. RHYTHMIC FLUCTUATIONS IN THE CARBON CONTENTS OF THE BLOOD.—It has been argued that in ordinary circumstances the carbon contents of the blood tend to vary inversely with the daily fluctuations of combustion (§ 300). Now if it depends upon the carbon contents, we shall expect to find the tension of the pulse varying inversely with the rate of combustion.

Conformably, Marey says:²—‘On observe le matin, au reveil, un ralentissement du pouls avec les caractères de la forte tension: le soir contraire le pouls s'accélère et présente le caractère de la tension faible.’ Haig agrees with Marey as to the character of the morning pulse, but he goes further and regards the pulse of 5 or 6 A.M. as often slower and of higher tension, in spite of the warmth of bed, than the pulse of an hour or two later.³ Here I would point out that 5 or 6 A.M. is exactly the time when we may infer from the observations of Liebermeister and Jürgensen that combustion stands at its lowest (fig. 1).

On the other hand, Haig considers that the high-tension pulse of the morning is prolonged up to about 2 P.M.⁴ This may be so in some cases. But my experience is that the tendency to slowness and high tension passes off as a rule during the forenoon, sometimes quite early as the combustion and temperature rise; and this is of course more clearly marked if the post-prandial rise of pressure is avoided by the omission of breakfast.

The milder forms of morning headache tend to pass off as

¹ *The Pulse*, 1890, p. 160.

³ *Ib.* p. 151.

² *Uric Acid in Disease*, Haig, 1897, p. 143.

⁴ *Ib.* p. 143.

the blood-pressure falls. Sufferers from these headaches, which appear to be always associated with an accentuation and a prolongation of the physiological pulse characters of the early morning, are well aware that their best course, when attacked, is to rise a little earlier and take a little more exercise than usual. Thus they hasten the rising combustion: the blood-pressure falls more rapidly; and the headache subsides sooner than it would otherwise have done. The morning cold shower must be a powerful stimulant to combustion; and its influence in dispersing the frequent 'headachiness' present on waking needs no insistence. Broadbent, speaking of the headache which is associated with high arterial tension, says: '¹—'It is sometimes a morning headache which disappears after the bath and breakfast.' But, in many cases, headaches come on only after breakfast: these in my experience are due to this meal, and may be dispersed by modifying the character and size of the meal, or by omitting it.

In non-pregnant women during the period of sexual activity, I have inferred a monthly pyraemic fluctuation which attains its maximum just before, and at the onset of, menstruation (§ 156); and we have seen also that it is at this exact time that extensive vaso-constriction and the consequent tendency to high general blood-pressure attain their highest degree (§ 455). It is true, these vascular changes have been explained by the demand for an increased delivery of blood to the uterus. But that does not preclude us from holding the view that the tendency to hyperpyraemia is a factor of the peripheral vaso-constriction.

§ 736. PREGNANCY.—It has been argued that utero-gestation, through the superadded anabolism, involves an increase in the usual rate of decarbonization; and during physiological pregnancy there is a material increase of blood-pressure. Hence, high blood-pressure may arise independently of hyperpyraemia or a tendency thereto. The high blood-pressure of pregnancy seems simple of explanation.

As already argued, the premenstrual increase of blood-pressure depends upon peripheral vaso-constriction and is adapted to increase the delivery of blood to the uterus (§ 465). In the event of conception, the demand for the increased delivery of blood will be continued. Not only so, but the

¹ *The Pulse*, 1890, p. 176.

demand will progressively increase as the foetus grows ; and this will involve a progressive increase of blood-pressure. Now such might occur through a progressive increase of peripheral vaso-constriction whereby more and more blood is diverted to the uterine area. But this would of necessity involve an unphysiological degree of anaemia and denutrition of the tissues generally. There remains but one alternative, namely, increased energy of cardiac action. But for this, cardiac hypertrophy will be demanded ; and physiological hypertrophy of the heart, especially of the left ventricle, occurs during normal utero-gestation.

We may conclude, then, that the high blood-pressure of pregnancy depends upon the maintenance of an added degree of peripheral vaso-constriction or hypertonus, combined with increased energy of cardiac action ; and that the increased pressure so attained is adapted to the maintenance of a full and rapid supply of blood to the placental area. But we are not called upon to deny that the necessity for increased renal elimination is a subsidiary factor of the increased blood-pressure.

The mechanism of the high blood-pressure of pregnancy is thus similar to the mechanism of the high blood-pressure of renal cirrhosis. In both cases, the high blood-pressure is adapted to secure a full and rapid blood-supply to special areas, though these areas differ (compare § 900).

§ 737. FAT-FORMATION.—A high grade of the fat-forming capacity, which, we have seen, tends to avert hyperpyrexia and to relieve its clinical manifestations, would seem to be largely inconsistent with high blood-pressure. Broadbent says :¹ ‘A marked tendency to obesity appears usually associated with small arteries and low tension ; and the thin wiry individual commonly has large arteries, which are conspicuous, not only from the thinness of the skin and the absence of subcutaneous connective tissue, but also, together with their size, they are markedly full between the beats.’ Later, the same author is equally definite on this point. He says :² ‘Obesity is usually associated with low pulse tension, the arteries also being small and the action of the heart weak.’ Galen pointed out that fat persons had smaller blood-vessels than lean ; but this no doubt applied to the veins.

¹ *Lancet*, 1887, vol. i. p. 610.

² *The Pulse*, 1890, p. 141.

§ 738. PYREXIA.—It has been argued that pyrexia is a most efficient acarbonizing process; and Broadbent points out that ‘arterial relaxation is the condition of the vessels characteristic of pyrexia.’¹ He says that even in the cold stage of an ague fit while the cutaneous arteries are constricted and the skin is cold and pallid, ‘the actual pressure within the vessel is not very great and the wave can be extinguished without much difficulty.’² The general blood-pressure is apparently low, for the action of the heart ‘is not that of violent effort to overcome obstruction, but is often irregular, sometimes intermittent with apparently an imperfect diastole, so that the ventricle has little blood to drive on into the arteries.’³ The cold stage of the ague fit is the stage of rigor; and I have already argued that the vaso-dilation which prevents a rise of blood-pressure from following the extreme cutaneous vaso-constriction is located in the functionally active muscular layer of the body (§ 374).

It will be needless to multiply evidence that pyrexia, for the most part, involves low blood-pressure, since its influence in this respect is generally admitted; but the vascular characteristics of phthisis, usually though not invariably a pyrexial affection, may be briefly referred to. ‘Marian investigated 100 cases, and found the blood-pressure always low except in three cases complicated by arterio-sclerosis. . . . Raynaud states that, “speaking generally, low tension of different degrees exists in all cases of tuberculous infection. . . . Potain also states that the tension is low in all stages of pulmonary tuberculosis. . . . John found that in thirty-five patients with early phthisis the blood-pressure varied between 90 and 100 mm. . . . In healthy people, the blood-pressure varied between 115 mm. and 130 mm.”’ (Hans Naumann).⁴

There cannot, I think, be much doubt that the low blood-pressure of phthisis is largely due to the pyrexia involved, or, more correctly, to the exaggerated combustion responsible for the pyrexia. Hence, as a general rule, the pressure is inversely as the temperature. Low blood-pressure, however, is not invariable in phthisis: in some, the pressure is above the normal. But in my experience, all such cases without excep-

¹ *The Pulse*, W. H. Broadbent, 1890, p. 180.

² *Ib.* p. 189.

³ *Ib.*

⁴ *Zeit. f. Tuberk. u. Heilst.*, 1903, quoted in *Epitome, Brit. Med. Journal*, October 17, 1903.

tion have been apyrexial or but very feebly pyrexial ; and the disease has been of slow progress, if not stationary. In one of my cases, with excavation at the left apex and total absence of pyrexia, the maximum systolic pressure in the brachial, measured by Martin's manometer, is habitually 220 mm. Hg. There are no renal complications in this case, and the tubercular affection has seemingly made no progress during the last four years. Many of these cases exhibit manifestations of hyperpyraemia other than high blood-pressure, for example headaches, neuralgias, slight anginal and asthmatic seizures.

The view that low carbon contents of the blood, or hypopyraemia, due to diminished carbonization and increased kata-bolic decarbonization or combustion, is an important factor in the vascular relaxation and consequent low blood-pressure of pyrexia, does not involve negation of other factors. There can be no doubt, for example, that the pyrexial vaso-dilation of the cutaneous area, one agent in the exaggerated heat loss, which is demanded by the exaggerated combustion and heat production of pyrexia, is an important factor. Moreover, prolonged pyrexia leads to weakness of the cardiac muscle ; and it may be that the increased body temperature has a direct paralysing influence upon the vascular muscle in some cases.

As already argued, the exaggerated combustion of pyrexia leads to disintegration of the fixed nitrogenous tissues of the body. Hence during the convalescent stage there is apt to be retarded combustion and retarded fat-formation, with consequent hyperpyraemia. Conformably, while low blood-pressure is almost invariable during the continuance of pyrexia, high blood-pressure may mark the convalescent stage : the post-pyrexial slow high-tension pulse is a well-known phenomenon. The view that this form of bradycardia depends upon hyperpyraemia is supported by the fact that the condition is seen chiefly in such convalescents as do not rapidly improve in nutrition, and that it rapidly disappears when fat-formation is well established. The best treatment in my experience is to reduce the carbonaceous intake to the amount that can be dealt with physiologically at the time, while reinvigorating the impaired nitrogenous tissues by a due supply of digestible and assimilable proteid.

§ 739. GOUT.—Broadbent says :¹—‘ Arterial tension is pre-

¹ *The Pulse*, 1890, p. 157.

sent in both acute gout and in chronic gout; and the name " suppressed gout," conveniently vague and open as it is to abuse, might perhaps serve useful purpose if it were employed to designate such states of impaired health in middle and advanced life as are characterized by the presence of unduly high arterial tension.'

Now gout of whatever kind depends, as I have argued or shall argue (Chapter XXIII), upon hyperpyraemia; and acute gout is a recurrent pyrexial acarbonizing process. Acute gout, however, is an infrequent acarbonizing process, at least in its early history: hence we shall not be surprised if, in some cases, there are many of the manifestations of unrelieved hyperpyraemia for a period before the outbreak of the acarbonizing paroxysm. Such, in fact, are not infrequent at this time: in some cases, they consist of bronchial catarrh which may amount to acute bronchitis, in others of various dyspeptic or nervous symptoms: these may persist for a week or two, and they constitute the premonitory symptoms of the acute gouty paroxysm by which they are in most cases promptly dispersed. Now one of the most prominent of these premonitory symptoms is, in my experience, a high-pressure pulse. In two cases, I have been called in to patients who were suffering from various symptoms, preceding an acute arthritic outbreak: in neither case had I any reason to foresee the arthritis, since they had not been affected previously; and in both high blood-pressure was a prominent feature. During the early part of the pyrexial attack, there was in both cases, just as in other pyrexias, some general vaso-constriction indicated by a tightened radial; but the pressure in this vessel did not seem so high as prior to the pyrexia. The vaso-constriction, however, and with it all tendency to general high blood-pressure, rapidly vanished during the progress of the pyrexia; and this was succeeded by prolonged general vascular relaxation and a condition of health physical and mental, better than had been enjoyed for some months. I do not say that the order of the circulatory changes described is the same in all cases, but I strongly suspect this to be the general rule. Clifford Allbutt says:¹—'I find that in many men badly afflicted with recurrent gout, if free from kidney disease and of temperate habits, rise of arterial pressure

¹ *Lancet*, March 7, 1903, p. 648.

does not occur : their vessels remain fairly healthy, and they attain to ripeness of years.'

It is, however, in 'abarticular' or 'irregular' gout, the gout which has missed relief through pyrexial acarbonization, and in chronic gout, the degenerated articular gout which has ceased to achieve efficient pyrexial acarbonization (see Chapter XXIII), that we shall expect to find high blood-pressure especially prominent. Clifford Allbutt, speaking of the influence of gout on blood-pressure, blames especially the non-articular form, 'for the frank form of gout leads less surely to high arterial pressure.'¹ Mitchell Bruce,² speaking of the influence of gouty conditions on the heart and arteries, points out that the second sound of the heart 'may be of ringing quality : *this more common in goutiness than in developed gout.*' (Italics mine.) The author adds :—'In agreement with this connexion, the radial pulse is more often tense in the subjects of irregular than of regular gout : altogether, high tension is found in one half the cases.' In chronic articular gout, so well recognized are the circulatory conditions that they hardly call for reassertion. Duckworth³ points out that 'the pulse is of high tension, full between the beats and firm—*pulsus durus*' ; and that the heart commonly presents all the signs of hypertrophy of the left ventricle.

§ 740. HAEMORRHAGE.—That haemorrhage plays the part of an acarbonizing process, has been argued (§ 154) : menstruation is a periodic physiological acarbonizing process. Hence we shall expect haemorrhage to be followed by a fall of blood-pressure. We have seen that this occurs as a result of the physiological haemorrhage of menstruation (§ 455) ; and it will be admitted without further argument that haemorrhage, otherwise induced, whether pathological or therapeutic (venesection), operates similarly. Of course it is not contended that the blood-pressure reducing influence of haemorrhage is due solely to acarbonization : undoubtedly it is due in the first place to reduction in the amount of blood in circulation. Hence the rapidity with which venesection reduces high blood-pressure.

Accordingly, venesection is now generally reserved for cases in which high blood-pressure is present in dangerous degree

¹ *System of Medicine*, vol. v. p. 911.

² 'Lettsomian Lectures,' *Brit. Med. Journal*, March 23, 1901, p. 702.

³ *Treatise on Gout*, 1890, p. 263.

and in which a rapid reduction is considered an urgent necessity. From its employment in such cases—cases like uraemia where convulsions are present or impending—Broadbent¹ reports the most strikingly beneficial results.

§ 741. GLYCOSURIA.—Glycosuria has been regarded as an acarbonizing process (§ 269); and it will not, I think, be difficult to show that glycosuria tends to reduce blood-pressure.

It must be admitted, however, that glycosuria and high blood-pressure are frequently to be observed in the one case and at the one time: this occurs mainly in the variety known as 'late diabetes.' Broadbent says:²—'Late diabetes is closely associated with the gouty diathesis. It may supervene in an individual who has had repeated attacks of gout, or who suffers from chronic gout, and when this takes place, the patient often feels relieved, and has not only less gouty pain, but is less depressed and has less indigestion and flatulence. There may, however, have been no overt gout. The state of the arteries, whether gout has been manifested or not, gives evidence of protracted arterial tension: they are large, full between the beats, not very easily compressible, and their walls are thick and dense.'

It is obvious that in such cases the high blood-pressure does not depend upon the diabetic condition. In the first place, the high blood-pressure antecedes by long periods, perhaps by years, the first appearance of sugar in the urine; and, although Broadbent does not say so, it seems probable that the onset of glycosuria is associated with some reduction of blood-pressure: at any rate, the symptoms which Broadbent says are relieved by the glycosuria are essentially similar to those which the same author ascribes elsewhere to high blood-pressure, or to the causes of high blood-pressure (§ 730). In the second place, it has been shown that the disappearance of glycosuria in these cases does not necessarily lead to any change in the vascular condition: Dr. Charles Purdy³ treated three cases successfully as regards the abnormal elimination of sugar, but unsuccessfully as regards the exaggerated blood-pressure. And finally, as Broadbent points out,⁴ 'in the more serious diabetes of the young, the pulse . . . is small and

¹ *The Pulse*, 1890, p. 257.

² *Ib.* p. 158.

³ *Journ. Amer. Med. Assoc.*, September 1885.
The Pulse, 1890, p. 159.

short, that is, the tension is low.' It is, of course, in this variety of diabetes that hyperglycaemia and glycosuria are most marked.

The above considerations seem to show that when high blood-pressure and glycosuria concur, they own factors in common: that the high blood-pressure is present in spite of the glycosuria; and that the real tendency of glycosuria is towards a reduction of blood-pressure.

§ 742. CONSTIPATION AND PURGATION.—James Mackenzie¹ points out that in some persons after middle life there are found periods during which the blood-pressure is higher than usual: that such periods not uncommonly concur with some degree of constipation; and that the pressure may be reduced by 'purgation, arising either spontaneously or by means of drugs.'²

Purgation is admitted by all authorities to be useful in reducing high arterial tension; and there seems little doubt that mercurial purgatives are especially useful. Broadbent says:³—'The great remedy for mischief of any kind impending as a result of high blood-pressure is a mercurial purge. The effect of mercury employed as an aperient upon abnormal tension in the arteries is matter of observation.' The mode of action of purgatives has been variously explained. On the theory that high blood-pressure is one expression of hyperpyraemia, the explanation seems simple. As already argued (§ 245), purgation, more especially purgation by mercurials, hastens the passage of the chyme over the absorbent surface of the small intestine, and thus restricts the supply of carbonaceous material available for absorption. The reduction of blood-pressure which follows is thus largely a manifestation of reduced pyraemia; but it is probably due in part also to splanchnic vaso-dilation and to the withdrawal of fluid from the circulation.

§ 743. PLUMBISM.—Broadbent says:⁴—'Lead-poisoning is another cause of high arterial tension, and it is noteworthy that it frequently gives rise to gout and kidney disease, the conditions already spoken of attended with excessive intra-arterial pressure.' It has been argued that lead-poisoning

¹ *The Study of the Pulse*, 1902, p. 72.

³ *The Pulse*, 1890, p. 182.

² *Ib.* p. 71.

⁴ *Ib.* p. 159.

leads to hyperpyraemia by retarding metabolism directly, and indirectly by causing anaemia (§ 232).

§ 744. THE PAROXYSMAL NEUROSES.—We have seen that the paroxysmal neuroses may depend upon hyperpyraemia and be conservative acarbonizing processes; and if, as here assumed, hyperpyraemia is responsible for high blood-pressure, then we shall expect to find a material reduction in blood-pressure following the paroxysms of any of these affections. I cannot find recorded by others any observations on this point, but from my own experience I have no doubt whatever that such is commonly the case, and that the reduction is maintained for a considerable portion of the ensuing inter-paroxysmal period.

In frank migraine, the feeling of well-being which succeeds an attack is commonly associated with reduction in the pulse tension. I have observed the same in a case of severe recurrent gastralgia, and frequently in the common bilious attack. A series of violent epileptic convulsions, associated with, and preceded by, very high blood-pressure, terminated fortunately in recovery, and was followed by prolonged relief from the high blood-pressure and from all its clinical manifestations. Dr. Hawkes tells me of a case of general paralysis associated with considerable tension of the pulse, in which a series of convulsions preceded a marked fall in blood-pressure; and 'Rosenstein'¹ states that an abnormal hardness and tension of the pulse commonly precedes attacks' of uraemic epileptiform convulsions. There can be little doubt that, in some cases, convulsions ascribed to uraemia depend really upon hyperpyraemia and are successful acarbonizing, and blood-pressure reducing, processes.

§ 745.—Broadbent² has made out a strong case in favour of the view that high blood-pressure is the cause of some convulsions. He divides convulsions into two classes:—

1. Convulsions in persons whose blood-pressure is habitually high: these, he considers, are due to the high blood-pressure; and he regards the prognosis as favourable.

2. Convulsions in persons whose blood-pressure is habitually low: these, he thinks, are causally connected with the low

¹ *Albuminuria and Bright's Disease*, Tirard, 1899, p 300.

² *The Pulse*, 1890, p. 281 *et seq.*

blood-pressure : he regards them as ‘ essential ’ epilepsy and their prognosis as unfavourable.

Now it seems to me that this is a most important clinical distinction, and I have been able to confirm it on several occasions. But the belief that high blood-pressure may depend upon hyperpyraemia and that convulsions are acarbonizing, and therefore blood-pressure reducing, processes, constrains us to view the subject from a somewhat different standpoint.

In both classes, we may believe that increasing hyperpyraemia leads to convulsions through cerebral anaemia, dependent on cardiac inhibition, compensatory of vaso-constriction and rising blood-pressure.

§ 746. In the first, we must believe that the tendency to convulsive acarbonization is slight : that the organism responds by convulsions only to high grades of hyperpyraemia ; and that, consequently, the habitual high blood-pressure is present through delay in the onset of convulsions. The prognosis as regards the fits, we must agree, is relatively favourable, since a tendency to convulsions so tardily evoked will naturally be preventable with comparative ease.

In accordance with the views expressed in Chapter XIII (§ 578), these, more than any others, are the cases in which epileptic convulsions really constitute pathological reinforcements of inadequate physiological acarbonization : in other words, convulsive acarbonization is not in these cases to any great extent prepotent. Consequently, there would be, antecedent to the convulsions, not only a high grade of hyperpyraemia manifesting itself in high blood-pressure, but also a high grade of uricaemia demonstrable by the thread test (compare § 631). I have not investigated the latter point. And it is clear, I think, that the cases here referred to would be comparatively amenable to acarbonizing therapeutic measures : such treatment in the main would concern modification of excessive *supply*. Indeed, all the therapeutic measures—venesection, mercurial purging, vegetarian and milk diet, fresh air and physical exercise—employed with such great success by Broadbent¹ in these cases of high-pressure convulsions manifestly operate by restricting the amount of carbonaceous material circulating in the blood.

§ 747. In the second class, we must believe that the

¹ *The Pulse*, W. H. Broadbent, 1890, p. 281 *et seq.*

tendency to convulsive acarbonization is strong: that the organism responds by convulsions to low grades of hyperpyraemia; and that thus the tendency to high blood-pressure is constantly kept down. In short, we must believe that the habitual low blood-pressure is the result, and not the cause, of the convulsions. Manifestly, such cases, if any, have a preferential claim to the title ‘essential epilepsy’; and the prognosis as regards the fits will be relatively unfavourable, since a tendency to convulsions so readily evoked will be preventable with comparative difficulty.

In accordance with the views expressed in Chapter XIII, these, more than any others, are the cases in which convulsive acarbonization is prepotent over physiological acarbonization. Consequently, there would be, antecedent to the convulsions, a mere relative hyperpyraemia, which might indeed amount to no more than physiological pyraemia; and the associated uricaemia would be slight, perhaps not demonstrable by the thread test. Further, it is, I think, clear that such cases would be highly resistant to acarbonizing therapeutic measures, even to such as would be dangerously severe in their operation. To overcome the tendency to convulsion in such cases we should have to succeed in abolishing the pathological prepotency: such treatment in the main would concern the modification of perverted *function*. Whether or no we are to succeed in abolishing pathological prepotency, will depend in the main upon the factors responsible for this condition. In the majority of cases of essential epilepsy in which the disorder has been of prolonged duration, it is probable that the pathological prepotency, or extreme facility of convulsive acarbonization, is the result of a progressively accentuated ‘memory of the body’: in such, the outlook is not bright. But in others it may be that some source of peripheral irritation is still in operation, is a largely responsible factor, and is removable, or at any rate remediable: in such the prospect would be less gloomy.

§ 748. That the mechanism of the convulsions, in some at least of the low-pressure cases, is identical with the mechanism of those in which the blood-pressure rules habitually high, almost follows from the views here adopted; but I may say that in one habitually low-pressure case, I observed on one occasion a very distinct tightening up of the radial artery during the aura, immediately succeeded by a few dropped or

imperceptible beats. Furthermore, were habitual low pressure, and not recurrent high pressure, the cause of the convulsions in these cases, then anything which tended to increase vascular tone would have a beneficial, at any rate not a deleterious, influence on the recurring attacks ; but Pugh¹ has shown that in epilepsy the administration of suprarenal extract (the most powerful vaso-constrictor known) increases the number of attacks.

§ 749. If Broadbent's conclusions inductively arrived at are correct, namely, that convulsive cases which manifest high blood-pressure during the intervals are much more amenable to (acarbonizing) treatment than convulsive cases which present interparoxysmal low blood-pressure, then it seems in the highest degree probable that something similar is true of the other paroxysmal neuroses. Interparoxysmal low blood-pressure would indicate pathological prepotency : interparoxysmal high blood-pressure, physiological prepotency ; and the distinction would constitute one of the most important elements in prognosis under acarbonizing treatment. Further, if, as already argued, it implies a high degree of hyperpyraemia, high blood-pressure would imply also a high degree of uricaemia : hence a high degree of interparoxysmal uricaemia (demonstrable perhaps by the thread test) would constitute a favourable element in prognosis under acarbonizing treatment. On the other hand, interparoxysmal low blood-pressure and low uricaemia would constitute unfavourable elements in prognosis under mere acarbonizing treatment : in cases presenting these features, our main chance of successful treatment would lie in the discovery and removal of some source of peripheral irritation, or other factor responsible for pathological prepotency.

I have not as yet fully verified these deductive speculations. But I have observed, as already pointed out (§ 578), that paroxysmal neuroses, such as recurrent headache and asthma, commencing during the course of renal cirrhosis, are often more than usually amenable to acarbonizing treatment. If, as I shall argue (§ 885 *et seq.*), renal cirrhosis is one of the terminal results of prolonged unrelieved hyperpyraemia, it is manifest that any intercurrent paroxysmal neuroses cannot be pathologically prepotent ; and this fact would seem to be sufficient

¹ *Brain*, 1902, p. 501.

to explain fully their comparative amenability to acarbonizing treatment.

§ 750. Reference may here be made to the investigations of M. Sihle, who finds, as a result of systematic measurements, that the blood-pressure is diminished in asthma, not only during the attack, but also to a less extent during the interval.¹ Now this statement as it stands is too exclusive: in justification of this objection, it is only necessary to refer to the frequent occurrence of asthmatic paroxysms in renal cirrhosis, an affection in which the blood-pressure rules persistently high; and there are many cases of asthma, unassociated with kidney disease, in which the blood-pressure is distinctly above normal, not alone during the paroxysm, but throughout the intervals. Nevertheless, I am prepared to admit that the commonest circulatory conditions to be found in asthma cases are paroxysmal and interparoxysmal low blood-pressure; and I am inclined to think that both conditions, but especially the latter, are, other things equal, proportionate directly to the degree of asthmatic prepotency, and therefore inversely to the removability of the asthma by mere acarbonizing treatment.

§ 751. PATHOLOGICAL ANABOLISM.—It has been argued that tumour formation is, *inter alia*, an acarbonizing process, and that malignant, that is, rapidly growing, tumours are peculiarly hostile to hyperpyraemia (§ 281). We shall expect, therefore, that in cancer blood-pressure will rule low. This seems fully borne out on appeal to clinical medicine. On one occasion, I saw a rapidly growing cancer develop in a patient whom I was treating at the time for other complaints, and a moderately early phenomenon was a marked decrease of blood-pressure. In the great majority of rapidly growing malignant tumours which have been under my care at the Diamantina Hospital for Chronic Diseases, the pulse tension was low, usually very low indeed, and this, even before ulceration had occurred and while the patient maintained a fair amount of strength and appetite. There are exceptions, however; and a low pressure is not always an early sign.

§ 752. NEGATIVE FACTORS IN PERSISTENT HIGH BLOOD-PRESSURE.—Pathological acarbonization, as we have seen, depends, *inter alia*, upon an inadequacy of physiological acar-

¹ *Wien. klin. Woch.*, No. 4, 1903, referred to in *Brit. Med. Journal*, Epitome, August 29, 1903.

bonization ; and in the etiology of unrelieved hyperpyraemia we have had to include an absence or inadequacy of pathological, as well as of physiological, acarbonization. But persistent high blood-pressure, I have argued, depends in many cases upon unrelieved hyperpyraemia. Hence in persistent high blood-pressure also we shall have to include an absence or inadequacy of pathological acarbonizing, or (what amounts to the same) pathological blood-pressure reducing, processes : these include, as we have seen, the long list of effectively acarbonizing paroxysmal neuroses, acute gout, febrile catarrhs, pyrexias, haemorrhagic affections, and many more. Manifestly, as we proceed with the evolution of hyperpyraemia, the number of negative factors claiming admission into etiology accumulates rapidly. This argument may serve to explain the clinical fact that persistent high blood-pressure appears not infrequently as the first manifestation of disease in middle life in persons whose lives previously have been free seemingly from all morbid manifestations.

§ 753. SUMMARY OF EVIDENCE AND CONCLUSIONS.—We have seen, on the one hand, that whatever conduces to, or is associated with, high carbon contents of the blood or hyperpyraemia, may conduce to, or be associated with, high blood-pressure. Amongst the conditions so operating are a mixed diet containing a sufficiency of proteid with an excess of carbonaceous material, a sedentary life, hot weather, various disorders associated with retarded combustion, the rhythmic retardations of combustion, the premenstrual and early menstrual stage, deficiency of fat-forming capacity, the post-pyrexial stage, the pre-paroxysmal and early paroxysmal stage of acute gout, irregular or abarticular gout, chronic articular gout, plumbism, and the immediately antecedent and early stages of the attacks of the paroxysmal neuroses.

We have seen, on the other hand, that whatever conduces to, or is associated with, low carbon contents of the blood or hypopyraemia, may conduce to, or be associated with, low blood-pressure. Amongst the conditions so operating are a mixed diet containing a low proportion of proteid, an almost purely proteid diet, muscular exercise, cool weather, the rhythmic accelerations of combustion, the late menstrual and post-menstrual periods, a well-developed fat-forming capacity, pyrexia, the later stages of the acute gouty paroxysm and

the succeeding period, haemorrhage, glycosuria, purgation, the termination of the attacks of the paroxysmal neuroses and the succeeding period, and pathological, more especially malignant, anabolism.

The conclusion to be drawn is that just as recurrent hyperpyraemia may give rise to recurrent high blood-pressure, so continuous or unrelieved hyperpyraemia may give rise to persistent high blood-pressure.

An extended deduction is that in physiological life the mean vascular tone—which, however, varies somewhat with the individual—depends very largely upon a certain normal mean in the carbon contents of the blood, upon a certain normal mean pyraemia.

The conception of a humoral factor in vascular tone is already entertained. Leonard Hill says:¹ ‘It is conceivable that the quality as well as the tension of the blood may be the exciting cause of vascular tone. An increase in the alkalinity of the blood favours the developement of tone.’ On the view here adopted, the carbon or fuel contents of the blood constitute at any rate one humoral factor. But this pyraemic view would by no means exclude other humoral factors; and recent researches seem conclusive that the suprarenal glands normally pour into the blood an internal secretion which is ‘beneficial to the muscular contraction and tone of the cardiac and vascular walls.’² It is conceivable that the supra-renal secretion is essential to the *capacity* which enables the vascular muscles to respond to pyraemic conditions, and that pyraemic conditions determine the *degree* of the contraction.

It has now been argued that the carbon contents of the blood tend to determine directly the blood-pressure, and inversely the excretion of uric acid: hence uricaemia will tend to vary directly as the blood-pressure. This has, I believe, often been demonstrated: at any rate, persistent high blood-pressure and uricaemia have frequently been noted to concur. Hence it is easy to understand how high blood-pressure has been ascribed to uricaemia. But there is no evidence to show that uric acid has any direct influence on blood-pressure: the variations of both are explicable by pyraemic variations. Pronounced uricaemia when associated, as so commonly occurs, with diminished

¹ *Text-book of Physiology*, E. A. Schäfer (1900), vol. i. p. 136.

² *Ib.* 1898, p. 958.

excretion of uric acid in the urine, should, I submit, be regarded as a symptom, possibly indeed as an index, of hyperpyraemia.

MECHANISM OF PERSISTENT HIGH BLOOD-PRESSURE

§ 754. An interesting and highly important epistolary discussion on this subject is to be found in the pages of the '*Lancet*' for 1903 (January to March inclusive). It is admitted by all that the increased blood-pressure depends fundamentally upon systolic force increased in accordance with the necessity for overcoming increased peripheral resistance. The points at issue comprise the site and nature of this increased resistance. Harry Campbell¹ thus ably sums up the divergent views which are held:—‘Sir William H. Broadbent holds that it (the increased peripheral resistance) has “its primary seat in the capillaries,” and that it is due to an alteration in the blood which so influences the vital reaction between that fluid and the capillaries as to interfere with the normal easy flow through these vessels—he assumes, as it were, an increased vital frictionality. Professor T. Clifford Allbutt attributes the essential cause of the morbid resistance to an increased viscosity of the blood by virtue of which (presumably) its mechanical (as distinguished from vital) frictionality is increased, while he is not disposed to assign to active vascular narrowing any influence in effecting a long-sustained high pressure. Finally, Sir R. Douglas Powell and Dr. William Russell place the chief resistance in the arteries and attribute it to a generalized hypertonus of them.’

With the last of these views the writer of the paragraph is in complete sympathy. He argues (1) that physiologists generally admit that normally the resistance in the capillaries is infinitesimal, about five-sixths of the total peripheral resistance being located in the arterioles: (2) that physiological variations in vascular resistance are almost wholly due to active alterations in the calibre of these same arterioles: (3) that a fractional addition to the normal resistance in the arterioles (which is about 70 mm. Hg) would be ample to account for pathological high blood-pressure: (4) that William Russell has

¹ *Lancet*, February 1903, p. 478.

shown that in general arterial hypertonus the muscular coat of most, if not all, of the systemic arteries is hypertrophied ; and (5) that, consequently, it is unnecessary to seek further for the mechanism of the resistance in persistent pathological high blood-pressure.

§ 755. Now we are not called upon to exclude from the mechanism of persistent high blood-pressure the operation of the factors suggested by Broadbent and Clifford Allbutt ; yet obviously the view accepted by Douglas Powell, William Russell, and Harry Campbell is the only one which is consistent with, and confirmatory of, the arguments pursued in this work. By the aid of facts and observations which are for the most part independent of each other, I have argued that (1) persistent high blood-pressure may depend upon continuous or unrelieved hyperpyraemia : (2) that processes, such as acute pyrexial gout, menstruation, and the paroxysmal neuroses, which depend upon and disperse recurrent hyperpyraemia or a tendency thereto, are preceded by, or associated with, increased vaso-constriction of the systemic arterioles in wide areas with tendency to high blood-pressure, and are succeeded by a generalized vaso-dilation with tendency to low blood-pressure—that all such processes are conservative against high blood-pressure, not less than against hyperpyraemia ; and (3) that recurrent hyperpyraemia, with its recurrent high blood-pressure, tends to pass by insensible gradations into continuous or unrelieved hyperpyraemia, with more or less continuous or persistent high blood-pressure. If these propositions are true, it is almost inconceivable that persistent high blood-pressure should differ in its mechanism essentially from recurrent high blood-pressure : we must ascribe it, in the main at least, to a state of continuous vaso-constriction of the arterioles in extensive areas, uncompensated, or inadequately compensated, by vaso-dilation in other areas, or by modification of cardiac action.

§ 756. Clifford Allbutt admits that temporary high blood-pressure may be due to vaso-constriction, but he cannot admit that vaso-constriction is the primary or chief cause of the protracted high pressure so often seen in elderly persons. Arguing from laboratory experiments in which the vaso-constriction following various procedures (for example, irritation of the sciatic nerve) is associated with a rise of blood-pressure

lasting at most but a few seconds, he says:¹—‘That vaso-constriction should be universal—*i.e.* should prevail in all areas at once—is contrary to experience: when it occurs in some areas it is counteracted by dilatation in others.’ The laboratory experiments which constitute the basis of this argument were performed presumably upon animals in a condition of physiological health. Now it has been an essential part of this argument throughout that vaso-constriction in physiological conditions tends to be fully compensated, either by vaso-dilation in other areas, or by cardiac inhibition, or by both, the accuracy of such compensation securing the constancy of the general or aortic blood-pressure. Further, it has been argued, so imperative are the needs of the organism for uniformity of general blood-pressure, that the operation of the law of compensation extends far into the domain of pathology—that the changes compensatory of vaso-constriction (vaso-dilation in migraine, asthma, angina, etc., cardiac inhibition in some cases of epilepsy) constitute the essential mechanism of many pathological processes. But it would be too much to deduce from this that compensation for vaso-constriction is invariably adequate throughout the whole domain of pathology: indeed, it may often be observed that the temporary vaso-constriction of many of the paroxysmal neuroses is inadequately compensated, and that there occurs an actual rise of general blood-pressure during some part at least of the paroxysm. It is easily conceivable, then, that under many conditions, such for example as the gradual wearing out of some recurrent neurosis, or other acarbonizing, and blood-pressure-reducing, process, compensation will become inadequate; and if Harry Campbell is correct in saying that a fractional addition to the normal resistance in the arterioles would be enough to account for pathological high blood-pressure, then it follows that a fractional inadequacy of compensation would be sufficient to induce the same condition.

RELATION OF BLOOD-PRESSURE TO URINARY EXCRETION

§ 757. WATER.—It has been found that, other things equal, a rise in general blood-pressure is accompanied by a greater

¹ *Lancet*, January 31, 1903, p. 330.

flow of blood through, and an expansion of, the kidney, with an increase in the flow of urinary water (Foster).¹ For this purpose, any widespread vaso-constriction of the systemic arterioles, so long as it is not fully compensated by cardiac modification or vaso-dilation in areas other than the renal, would suffice: the polyuria and the implied renal vaso-dilation would be compensatory, since they would tend to anticipate or reduce the rise of general blood-pressure. The mechanism of polyuria would thus be identical physiologically with the mechanism of the headache of migraine, the dyspnoea of asthma, the pain of angina, gastral-gia, etc.: it would differ from these manifestations of pathologically exaggerated vaso-motor action in localization only. Hence anything which induced any extensive vaso-constriction would be liable to be associated with polyuria and increased frequency of micturition.

Exposure to cold tends to cause vaso-constriction of the cutaneous area; and it is an old observation that cold weather, especially sudden cold weather, greatly increases the flow of urine; though I believe we are accustomed to ascribe this phenomenon mainly to inhibition of perspiration which doubtless is to some extent responsible. The influence of sudden external cold on the flow of urinary water is observable in many circumstances. It is very conspicuous to the traveller on an ocean liner, more especially perhaps on one that is homeward bound about the middle of the Red Sea in the northern winter: here, at this season, the tropical wind from the Gulf of Aden is not infrequently replaced suddenly by a cold northerly breeze from the Mediterranean, with the result that the lavatory accommodation is apt to become suddenly inadequate. And there is no doubt that some increase in the flow of urine, with a diminution in the specific gravity, is one of the commonest results of cold bathing in typhoid fever.²

As already seen (§ 397), various *emotions*, chiefly those of a depressing nature, are apt to be associated with cutaneous vaso-constriction. *Fear* is one of these: its influence in causing increased secretion of urine, leading in some cases to involuntary urination, has been depicted in no compromising spirit by Emile Zola in the ‘Downfall.’ *Anxiety* is not far removed

¹ *Text-book of Physiology*, M. Foster, 1895, p. 692.

² *The Cold-bath Treatment of Typhoid Fever*, F. E. Hare, p. 79 *et seq.*

from fear; and its influence has been observed, if not experienced, by many of us in Lincoln's Inn Fields.

Menstruation, especially at the commencement of the flow, is associated with a distinct tendency to widespread vaso-constriction and increased general blood-pressure (§ 455); and Helen MacMurchy¹ has found that in 48 per cent. of healthy women an increased quantity of urine is commonly passed at each menstrual period. I have known the act of micturition increase from four to ten times in the day during menstruation. The increased diuresis is most marked at night, just as it is in Bright's disease; and it affects mainly the day preceding, and the first day of, menstruation, following the variations of blood-pressure in both instances. The increase in the number of micturations does not depend upon vesical irritability, though this may be present; for there is an actual increase in the amount of the urine passed. Further, the increased diuresis can be shown to be proportionate to the degree of the cutaneous vaso-constriction. Menstruation is known to vary even in the same individual at different periods. On some occasions it is a comparatively tranquil, on others a more stormy process; and the symptoms fluctuate proportionately. Three of my patients have made a series of personal observations on these points; and they are all agreed that, in their case, the amount of the menstrual loss, the diuresis and the pallor, dryness and shrivelled appearance, and sensation of chilliness, of the skin, vary directly and proportionately.

§ 758. The *initial stages of pyrexia* are usually associated with vaso-constriction of the skin: this amounts, in some cases, to rigor. In either case, the passage of pale urine in increased quantity is the rule. During the *cold stage of the ague fit*, 'Watson² spoke of the urine as scanty, although passed frequently; but the careful measurements of Redtenbacher and of Ringer have shown that it is in reality considerably increased in quantity when compared with the amount passed each hour during the apyretic interval' (Fagge). The increased flow of urine is an early symptom: it may commence before the cutaneous vaso-constriction has advanced sufficiently to cause chilliness:³ it is probably due to inadequate compensation by the vaso-dilation of the muscular layer. 'The hot⁴ stage

¹ *Lancet*, 1901, October 5, p. 910.

² *Text-book of Medicine*, Fagge, 1891, vol. i. p. 324. ³ *Ib.* ⁴ *Ib.* pp. 324, 325.

gradually succeeds. . . . The urine during this period is described as differing in appearance from that of the cold stage, being now high-coloured and concentrated; and both Watson and Hertz speak of it as passed in but small quantity. . . . The sweating stage follows in its turn. . . . All observers speak of the urine during this period as differing from that passed in the previous stages in showing a thick deposit of lithates.' (Fagge.)

In typhoid—and probably in most continued fevers—the succeeding variations in the urinary excretion of water run generally parallel, but may be less clearly defined; and they extend over days or weeks instead of hours. During the invasion period of slight cutaneous vaso-constriction and rising temperature, there is commonly some degree of diuresis: Haig, speaking of slight pyrexial attacks, associated with pricking and shooting pains in the joints, in his own person, says: ¹—‘The first rise of temperature may run the urine up from say 50 c.c. an hour to 150 c.c. in the same time, and this continues for three, four, or five hours.’ During the middle stages of general vascular relaxation, the urine is apt to be scanty and high-coloured, with irregular deposits of lithates: conformably, Professor J. Bauer says: ²—‘In the opinion of Leyden, it is very probable that during the height of the fever a retention of water in the tissues actually takes place.’ But in early convalescence, the tone of the peripheral arteries is largely recovered, as pointed out by Marey; and concurrently there is again a distinct tendency to polyuria—‘the critical polyuria’ of MM. Tripier and Bouveret.³

Broadbent⁴ refers to the case of a lady of 75 who ‘caught a chill, and the arteries, which were usually large, were found to be tightened up, small, and incompressible. . . . The urine, previously normal, became temporarily extremely copious and pale, had a specific gravity of only 1·006 or 1·008, and contained a small proportion of albumen.’

§ 759. Extensive vaso-constriction, usually of the skin, is the rule during attacks of the *paroxysmal neuroses* (§ 350); and paroxysmal polyuria has been observed in most. This has

¹ *Uric Acid in Disease*, 1897, p. 491, footnote.

² Ziemssen’s *Handbook of Therapeutics*, vol. i. p. 191.

³ *The Cold-bath Treatment of Typhoid Fever*, F. E. Hare, 1898, pp. 79, 80.

⁴ *The Pulse*, 1890, p. 153.

already been referred to in the case of asthma (§ 381) and of epilepsy (§ 263): in migraine ‘profuse secretion of urine is mentioned by several writers—Whytt, Calmeil, Labarraque, and others’:¹ Troussseau² noticed the same in a case of angina pectoris: Munro³ says that ‘an unusual quantity of urine (nervous urine) may be passed before an attack of Raynaud’s phenomena even in children’: Herman B. Baruch⁴ has observed the same in angio-neurotic oedema; and Troussseau⁵ and Dr. Hawkes, in trigeminal neuralgia.

In the foregoing cases, the widespread systemic vasoconstriction and consequent tendency to general high blood-pressure are temporary or recurrent: hence the polyuria is temporary or recurrent. But in many pathological conditions, there is persistent high blood-pressure depending, as already argued, upon a condition of continuous exaggerated vasoconstriction or hypertonus of the systemic arterioles. In these cases, we shall expect to find a more or less continuous polyuria; and the expectation will be in great part fulfilled.

§ 760. In *plumbism* there is persistent high blood-pressure depending, as already argued (§ 743), upon unrelieved hyperaemia; and in a case recently under my treatment, there was thirst and a somewhat profuse excretion of urine of low specific gravity but free from albumen. I am aware that during actual attacks of lead colic there is commonly marked diminution of urinary secretion: such is possibly due to concurrent vaso-constriction of the renal arterial system.

Abarticulär, latent, or irregular gout, according to my view, is simply hyperpyraemia, unrelieved or inadequately relieved by pathological acarbonization, articular or other: it is often associated with more or less high blood-pressure and then, according to my experience, with some degree of polyuria. Of *chronic articular gout* which, as I shall argue (§ 843), implies a state of unrelieved hyperpyraemia, and which is commonly if not invariably associated with persistent high blood-pressure, Duckworth says:⁶—‘The urine may be copious . . . pale . . . of low range of specific gravity, 1·005 to 1·015’: he adds that several micturitions are common during the night, and that associated cardio-vascular and retinal changes may be looked

¹ *Megrism and Sick-headache*, 1873, pp. 149, 150.

² *Ib.* p. 150.

³ *Raynaud's Disease*, 1899, p. 137.

⁴ *Med. Record*, 1902, August 19, p. 257.

⁵ *Clin. Med.*, New Syd. Soc., vol. i. p. 109.

⁶ *Treatise on Gout*, 1890, p. 125.

for. The *cirrhotic kidney*, I shall argue (§ 885 *et seq.*), is one of the terminal results of prolonged hyperpyraemia and its associated secondary uricaemia : it is almost invariably marked by persistent high blood-pressure, so long, at least, as the patient is holding his own and until near the end of the case ; and Roberts says :¹—‘With the granular contracting kidney, the urine is abundant (three or four pints a day) in the middle periods of the disease ; but it gradually grows scantier towards the termination : in exceptional instances the diuresis is profuse, and the urine may occasionally amount to five and even nine pints a day.’ The terminal scantiness of secretion is probably due to progressive heart failure.

§ 761. On the other hand, anything, therapeutic measures, medicinal such as the *nitrites*, thermal such as *vapour baths*, or intercurrent disease such as *pyrexia*, which is capable of reducing the peripheral vascular spasm and so the general blood-pressure, is capable also of diminishing the flow of urine. This hardly needs further proof or much insistence. Roberts points out that during intercurrent pyrexial attacks the increased diuresis of granular kidney may cease and dropsical effusion take its place ; and I would suggest that much of the feeling of comfort and relief which accrues from the use of vapour baths in this disease, and which is commonly ascribed to diaphoresis and the elimination of excrementitious matters supposed to be so brought about, is really due to the relief of peripheral spasm : in not a few cases, I have seen even greater relief from the administration of nitro-glycerine which was followed by diminished diuresis and diminished thirst, without the intervention of sweating. The subject will be returned to later (§ 901 *et seq.*).

There seems to be little doubt, then, that in pathology, as in physiology, the excretion of water varies to a large extent directly with the general blood-pressure.

§ 762. WATER AND URIC ACID.—But we have seen that the general blood-pressure tends to vary directly with the carbon contents of the blood (§ 753) ; and that the excretion of uric acid tends to vary inversely with the carbon contents of the blood. Hence the excretion of water and the excretion of uric acid should tend to alternate. And this is the conclusion which Haig has reached from frequent experimental

¹ *Urinary and Renal Diseases*, W. Roberts, 1885, p. 460.

observation, and upon which he constantly insists. He says :¹ ‘In every one, from hour to hour and from day to day, the excretion of water from the kidney varies in the reverse direction with the excretion of uric acid.’ In effect, water is excreted for the most part under high general blood-pressure, because high blood-pressure dominates the excretion of water : uric acid is excreted for the most part under low general blood-pressure, not because low blood-pressure dominates the excretion of uric acid, but because low blood-pressure commonly implies acarbonization, or a tendency to low carbon contents of the blood. That it is the acarbonization, and not the low blood-pressure, which dominates the excretion of uric acid, is shown by the fact that in some circumstances acarbonization proceeds under high blood-pressure, or at any rate under a tendency to high blood-pressure : then it may happen that uric acid and water excretion are increased concurrently or nearly so. For example, it is during the initial stages of, if at all during, pyrexia that there is cutaneous vaso-constriction with tendency to high blood-pressure ; and it is during the initial stages that both water (§ 758) and uric acid (§ 626) excretion are in excess.

An important practical deduction from the general rule that the excretion of water varies in the reverse direction with the excretion of uric acid is that we cannot hope to increase the elimination of uric acid from the blood and so reduce uricaemia by administering large draughts of water, hot or cold, although we may quite probably by this means increase the solvent power of the urine for uric acid and its salts, and so anticipate or disperse urolithiasis (§ 645). We can, however, promote the excretion of uric acid retained in the blood and reduce uricaemia, by reducing the carbon contents of the blood, and we may do so in any of the ways already so often referred to.

§ 763. The tendency to separation between the excretion of water and the excretion of uric acid may be observed in the domains of both physiology and pathology. It may be observed in the *diurnal cycle*. From 11 P.M. to 4 A.M., we have seen that the carbon contents of the blood and the blood-pressure tend to be high (§ 735) : during these hours, according to Haig, the excretion of water is high, that of uric acid low ;² and it is during these hours that the sufferer from granular kidney, and, I think, those who suffer from other disorders associated with

¹ *Uric Acid in Disease*, 1897, p. 313.

² *Ib.* pp. 16, 17.

persistent high blood-pressure, are mainly troubled with frequent desire to urinate. From 7 A.M. to 11 P.M., on the other hand, we have noted a tendency to the opposite conditions of the blood and blood-pressure ; and during these hours, the opposite relation obtains between the water and uric acid excretion.¹ Of course due allowance has to be made in such observations for variations of excretion due to variations of the intake of water and uric acid-forming material.

The alternation between water and uric acid excretion may, I think, be clearly detected at the *menstrual period*. The excretion of water follows for the most part the blood-pressure which attains its maximum on the day preceding and the first two days of the flow (§ 455). The increased diuresis, already referred to on the authority of McMurchy, often in my experience precedes the flow—I have known the increased diuresis precede the menstrual flow by a whole week ; and according to Haig, on the first day of menstruation ‘water is fairly high’ and on the third day it falls ‘very decidedly.’² On the other hand, the last authority has been already quoted to the effect that during menstruation there is a diminished excretion of uric acid ‘just before or at the beginning of the period, followed by a corresponding plus excretion during the period and just after its termination’ (§ 616).

Sustained *physical exercise* which promotes decarbonization of the blood, and so releases uric acid from the blood and permits of its free excretion in the urine, at the same time reduces blood-pressure and increases perspiration, thus in two ways diminishing the urinary water: this alternation is very clearly shown on the chart (Fig. 7) copied from Haig’s work.

§ 764. Of *acute gout*, Duckworth says :³ ‘It has occasionally been observed that free emission of a pale and watery urine has occurred before an articular attack.’ This ‘was marked in the case of an army-surgeon. . . . He noted that his urine was very copious and pale for from five to seven days before the attacks, and on one occasion it had been so for three weeks before a paroxysm.’ It is, of course, at the very end of the interparoxysmal period that hyperpyraemia may be supposed to attain its climax: it is precisely at this time that the patient may be observed to be suffering most severely from

¹ *Uric Acid in Disease*, 1897, pp. 16, 17.

² *Ib.* p. 121.

³ *Treatise on Gout*, 1890, p. 118.

many of the clinical manifestations of hyperpyraemia, amongst them from high blood-pressure ; and it is then that Garrod has shown that uric acid is deficient in the urine. On the other hand, at or shortly after the onset of the acute articular paroxysm, the polyuria ceases, doubtless in response to the tendency to general vascular relaxation characteristic of pyrexia : at this time, according to Bence Jones,¹ with whom Garrod is in substantial agreement, ‘the urine is of a deeper colour than natural, is secreted scantily with relation to the quantity of the patient’s drink, and, on cooling, deposits a pink or brick-dust sediment, with much mucus. The specific gravity is increased beyond the healthy standard. . . . A deposition of pink or brick-dust sediment on the cooling of the urine is of such ordinary occurrence when any active symptoms of gout are present, that its connexion becomes forcibly impressed on the mind of the patient, and he gives it the name of gouty urine.’ The sediments which appear very shortly after the onset of the paroxysm may or may not indicate excess excretion of uric acid : probably in most cases they do, as compared with the extremely deficient excretion of the immediately antecedent period of increased diuresis : they are in either case largely due to deficient solution, dependent on deficient urinary water and excessive urinary acidity. But the marked excess excretion of uric acid, indicating the full releasement of the uricaemia, comes later—from the second to the fourth day (Lecorché)—or at the end of the attack (Garrod), that is, when the acarbonizing pyrexia has had time to disperse the hyperpyraemia : the differences between Lecorché’s and Garrod’s observation depend, as already urged, probably upon the varying intensity of the pyrexia and the consequent varying rapidity of acarbonization. Clearly, in acute gout there may be a wide separation between the greatest excretion of water and the greatest excretion of uric acid.

In *chronic articular gout*, excess excretion of water and excess excretion of uric acid are still more widely separated : indeed here they practically part company altogether. In this condition, as I shall argue, there is chronic or unrelieved hyperpyraemia : this is associated with chronic uricaemia, chronic or persistent high blood-pressure, and a tendency to chronic polyuria ; while uric acid excretion tends to be con-

¹ *Gout and Rheumatic Gout*, Garrod, 1876, p. 125.

tinually below the normal (§ 843). The same is true, in all items, of the *cirrhotic kidney*, which is indeed a frequent associate of chronic gout and probably of many other clinical states, regarded as *abarticular gout* and dependent upon, and manifesting, similar humoral and vascular conditions.

§ 765. Of the asthmatic polyuria, Salter says¹:—‘The abundant secretion generally comes on soon after the asthma commences, but I have known it come on so early that the patient was awakened from his sleep by the distension of his bladder, when the difficulty of his breathing was only just commencing. It generally lasts for the first three or four hours, and then ceases altogether.’ As regards the excess excretion of uric acid which presumably follows, I have no facts at my disposal: Haig does not seem to have made quantitative analyses in this affection. It is true that towards the end of the paroxysm uratic deposits are common; but these do not necessarily indicate excretion in excess, since they may mean merely deficient solution, depending on antecedent polyuria and concurrent diaphoresis. There cannot be much doubt, however, on analogical grounds that towards the end of the paroxysm there is an excess excretion of uric acid, just as there is after all other pathological, and after physiological, exercise.

We have seen that in some cases of *major epilepsy* the attacks are associated with increased diuresis (§ 263); and Haig has shown that in the urine which passes into the bladder during and after a fit there is an excess of uric acid, which excess is directly proportionate to the severity of the fit (§ 623). The question then is, when does the increased diuresis occur with regard to the increased excretion of uric acid? It seems to me that this will depend largely upon the duration of the antecedent or initial vaso-constriction of the systemic arteries. In essential epilepsy—the low blood-pressure convulsions of Broadbent—the initial vaso-constriction tends, as already argued, to be sudden and to cover only a short space of time before the vagus inhibition of the heart: such could have but little influence upon the excretion of water from the kidneys. The convolution itself begins with a precipitate fall of blood-pressure: it is only towards the termination of the clonic spasms that this is regained and raised above

¹ *On Asthma*, 1868, p. 69.

the normal mean (§ 434). It may be, then, that in this case increased diuresis does not occur, or if it does occur, that it is terminal or deferred later still: in the latter case, it would tend to concur with the increased uric acid excretion demonstrated by Haig. But it will, I think, be otherwise with the high blood-pressure convulsions of Broadbent. Here the vasoconstriction responsible for the high blood-pressure is of long antecedent duration, though it may reasonably be supposed to increase progressively up to the point at which there becomes demanded the vagus inhibition of the heart-beat immediately responsible for the fall of blood-pressure, brain anaemia, and convulsions. In this case, there would be ample time for a largely increased diuresis: the increased water excretion and the increased uric acid excretion would be widely separated; and the order of precedence of these two phenomena would be the more usual one. In the case mentioned (§ 744), in which persistent high blood-pressure was markedly relieved by a series of convulsions, there had been distinct diuresis for several days (especially at night) before the series commenced; and I have read of an epileptic whose attacks were nocturnal, and who was often awakened by distension of the bladder, the fit occurring sometimes while he was in the act of micturition. The separation between the increased water excretion and the increased uric acid excretion is further evidenced by Haig's extremely important observation, already recorded (§ 623), that, in a case of major epilepsy, during 'the seven hours preceding the fits, the uric acid excretion was very small . . . in spite of the fact that these hours included the alkaline tide after breakfast, when the excretion of uric acid should normally have been large.' It is, of course, at such a time that we should expect to find the marked uricaemia shown by Garrod to be present in some cases of epilepsy (§ 623).

§ 766. In *migraine* there are, as we have seen, increased diuresis and increased excretion of uric acid. The two seem not to concur but to be separated as elsewhere; but the order of precedence would seem to vary in different cases. In all cases, the increased excretion of uric acid occurs during the attack: probably the excretion increases progressively up to the end, and perhaps to beyond the termination, of the attack as acarbonization of the blood proceeds. In several of my cases, there was marked antecedent diuresis. In one the

patient, whose attacks commenced insidiously about 4 A.M., was often awakened about this time by distension of the bladder: this did not occur with every attack, but whenever it did, he noticed some of his accustomed premonitory symptoms of migraine, such as slight malaise and chilliness, and on no one of these occasions did the paroxysm fail to develop during the forenoon. In another case, one of irregularly recurrent migraine, the actual attack commenced on waking in the morning: there was general headache, with flushing and objective heat of the forehead and scalp, extreme coldness of the extremities with constriction of the radial artery, and prolonged vomiting of bilious fluid: while the headache persisted, and throughout the following day, the urine was scanty, high-coloured, and thick with urates. But, for about twenty-four hours before every attack, there were unmistakable premonitory symptoms: these consisted of extreme sense of fatigue with unusual hunger, occasional flashes of red or yellow before the eyes, and greatly increased diuresis: the number of micturitions and the quantity of urine passed were increased about threefold.

But in many, perhaps the majority of, cases of migraine, the polyuria is terminal. For this at least two possible explanations suggest themselves.

1. Although there is, in most cases, widespread vaso-constriction of the cutaneous area, yet there need be no actual rise of blood-pressure: there may, indeed, be a tendency to a fall thereof. For the vaso-dilation essential to the attack may extend beyond the cephalic area and the hepatic artery: it may, for example, affect the splanchnic area—migraine sufferers have been observed to be liable to violent epigastric pulsation.¹ Such additional vaso-dilation might over-compensate for the cutaneous vaso-constriction, and result in a tendency to a fall in general blood-pressure, demanding compensatory acceleration of the heart-beat—an increase in the rapidity of the pulse in migraine has often been observed (§ 356). This tendency to a fall of general blood-pressure need not be sufficient to remove all abnormal strain from the dilated cephalic area and so abolish headache. In such cases, we should expect a diminution in the flow of urine during the attack, an increase thereafter.

2. Haig assumes that in migraine obstructed capillary circulation is general throughout the body: he accounts in this

¹ *Megrism and Sick-headache*, Liveing, 1873, p. 334.

way for the diminished diuresis during the paroxysm. To this I cannot of course assent, since I have ascribed the headache of migraine to vaso-dilation of some cranial area. Nevertheless, a vaso-constriction of the renal arteries concurrent with the cutaneous vaso-constriction would fully account for the retention of water during the paroxysm, even in spite of increased general blood-pressure; and the advent of polyuria at the end of, and after, the paroxysm would be explained by the recovery of the normal general vascular balance. The mechanism of the diminished excretion would, on this view, be identical with the mechanism of the diminished excretion which Lauder Brunton¹ has shown may follow the administration of digitalis, a drug tending to cause *general* vaso-constriction: it would be identical also with the diminished excretion which occurs in some typical cases of eclampsia² (Oliphant Nicholson). Conformably with these two explanations, I may quote the following paragraph from Harry Campbell: ³—‘It must be borne in mind that universal arterial constriction and dilatation both lead to diminished urinary excretion—for the result in either case is diminution in capillary blood-pressure. The most effective way of raising blood-pressure in the renal glomeruli is by a dilatation of the renal arterioles and a constriction of all the others.’

§ 767. WATER, URIC ACID, AND UREA.—Urea is always present preformed in the blood: ‘in the dog for instance it is found to an extent varying from .035 p.c. in hunger, to .153 p.c. after heavy feeding’; ⁴ and ‘if the kidneys by disease or by ligature of the ureters be so damaged as to be unable to carry on their work, an accumulation takes place in the blood, not, as was once thought, of some antecedent of urea such as kreatin, but of urea itself’ ⁵ (Foster). Hence urea is not elaborated in any way by the kidneys: it is simply removed from the blood by these organs and excreted in the urine. This work is accomplished by means of the epithelium of the tubules. But for its satisfactory performance, a due supply of water is essential: hence ‘when ⁶ urea . . . is injected into the blood, the result is not a mere increase in the proportions of urea . . . present in the urine which is being excreted. The injection

¹ *Pharmacology, Materia Medica, and Therapeutics*, 1885, pp. 376, 377.

² H. Oliphant Nicholson, *Lancet*, April 11, 1903, p. 1057.

³ *Headache*, 1894, p. 170.

⁴ *Text-book of Physiology*, Foster, 1895, p. 702,

⁵ *Ib.* pp. 702, 703.

⁶ *Ib.* p. 703.

leads to an increase in the flow of urine' (Foster). We shall expect, therefore, the excretion of urea to bear some amount of direct relation to, or to rise and fall with, the excretion of water. This is, in effect, what occurs : Haig's¹ charts of the urinary excretion in various circumstances (all those, that is, which contain curves of the excretion of water and urea) show the parallelism anticipated with scarcely an exception.

But we have already seen that water excretion and uric acid excretion tend to vary inversely : hence it follows that uric acid excretion and urea excretion will tend to vary inversely. And this conclusion has been reached through another route by Haig,² who says :—‘ It is, I believe, a universal law dominating both physiology and pathology, that high uric acid means low and failing urea, and low uric acid means rising and high urea.’

§ 768. We may terminate this part of the subject by arranging in two columns some of the humoral, vascular, and urinary variations, which tend to be associated respectively with an increase and a reduction in the carbon contents of the blood.

TABLE VII.

Mean carbon contents of the blood.

Raised.		Lowered.	
High carbon contents.		Low carbon contents.	
High general blood-pressure.	Low uric acid excretion.	Low general blood-pressure.	High uric acid excretion.
High water excretion.	High uric acid contents of blood or uricaemia.	Low water excretion.	Low uric acid contents of the blood.
High urea excretion.		Low urea excretion.	
Low urea contents of the blood.		High urea contents of the blood.	

Thus increased diuresis, which alternates with increased uric acid excretion, tends to concur with uricaemia, which again alternates with increased uric acid excretion. The last alternation we have reached before : it was long since pointed out by Garrod in the case of gout ; but it will, I am convinced, be found to be largely true throughout physiology and pathology.

¹ *Uric Acid in Disease*, 1897, Figs. 1, 2, 3, 9, 16, 17, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 39, 40.

² *Ib.* p. 129.

SUMMARY OF CONCLUSIONS

§ 769. In this chapter, I have argued that recurrent high blood-pressure may depend on recurrent high carbon contents of the blood, or hyperpyraemia : that continuous, or persistent, high blood-pressure may depend on continuous, or unrelieved, hyperpyraemia : that in both cases, the mechanism of the high blood-pressure consists of vaso-constriction of peripheral arterioles in wide areas, uncompensated, or inadequately compensated, by vaso-dilation in other areas, or by modification of cardiac action : that the excretion of urinary water tends to vary directly with the blood-pressure and, therefore, directly with the carbon contents of the blood : that the excretion of uric acid tends to vary inversely with the carbon contents of the blood and, therefore, inversely with the blood-pressure : that the excretion of urea tends to concur with the excretion of water and, therefore, to alternate with the excretion of uric acid ; and finally, that hyperpyraemia, high blood-pressure, uricaemia, and polyuria—or the physiological equivalents of these pathological conditions—tend to concur, and to alternate with the opposite conditions.

CHAPTER XX

§§ 770-783

Unrelieved hyperpyraemia (*cont.*)—Respiratory manifestations—Chronic catarrhal conditions of the upper respiratory passages, etc.—Chronic bronchial catarrh or chronic bronchitis: fluctuations in the carbon contents of the blood: other hyperpyraemic affections: physiological acarbonization: pathological acarbonization: relations between chronic bronchitis and asthma: treatment dietetic and other—Special forms of chronic bronchitis—Summary.

§ 770. As with the respiratory acarbonizing processes, so with the respiratory manifestations of unrelieved hyperpyraemia, it is obvious that they are all primarily vaso-motor, or at any rate vascular, in origin; and consequently, from the standpoint of strict nosology, they do not merit separate classification, except as a group subordinate to the vascular manifestations of unrelieved hyperpyraemia. The grouping adopted is merely for convenience, and in deference to existing systems of classification.

CHRONIC CATARRHAL CONDITIONS OF THE UPPER RESPIRATORY PASSAGES, ETC.

§ 771. It would seem certain that many chronic catarrhal conditions are, at least in great part, due to the persistence of the same blood-state, hyperpyraemia, which seems to be the underlying factor in many acute catarrhs. The chronic conditions may be observed to be dispersed at times by the same physiological acarbonizing agencies (fresh air, physical exercise, increased fat-formation, etc.) which are effectual in dispersing the tendency to the recurrent acute affections; and they are amenable in like degree to the same therapeutic measures, dietetic and other.

Dr. Samuel S. Wallian¹ treated seventeen cases of chronic

¹ *Oxygen and other Gases in Medicine and Surgery*, pub. F. A. Davis, 1889, p. 240.

nasal catarrh by oxygen inhalations : three were cured or fully relieved : six were sensibly relieved ; and eight were little or not at all relieved.

A large number of my cases suffering from various hyperpyaemic affections, were affected with some form of chronic catarrh of the upper respiratory passages ; and in practically all the catarrh abated or disappeared under the acarbonizing treatment recommended in this work. This was especially manifest in Case LXI, in which there was long-standing congestion of the fauces, naso-pharynx, and larynx, enlargement of tonsils, and oedema and elongation of the uvula. Dr. Hawkes reports a case of chronic post-nasal catarrh completely cleared up by diet and exercise.

Many instances, too, are recorded in which pathological acarbonizing processes of various kinds, neurosal, pyrexial, and other, have been followed by a similar result. Rousseau, speaking of a case of epilepsy, says :¹—‘The only ailment he ever had was chronic coryza, dating many years back, and which ceased suddenly at the time when he first became subject to attacks of *haut mal*. This coincidence led him to ascribe his disease to the sudden disappearance of the coryza.’ In this case, probably, both Rousseau and his patient were at fault. The inverse correlation of the two disorders was no mere coincidence ; nor was the disappearance of the catarrh responsible for the epilepsy. On the contrary, it seems almost certain that the chronic catarrh was dispersed by the recurrent acarbonizing convulsions.

§ 772. The dispersion of many chronic catarrhal conditions by an attack of any of the acute specific fevers, or by acute gout, may often be observed. In the following case, the curative influence of a mild artificially induced pyrexia seems beyond dispute :—

A rather thin girl of 24 was seen by me in consultation with Dr. Hawkes. She was employed in a shop from 9 A.M. to 6 P.M., and had suffered for two years on and off from attacks which presented some of the features of Menière’s disease and some of those of minor epilepsy : the diagnosis hovered between these two complaints. She was, at any rate, adjudged to be suffering from hyperpyaemia. She had already been treated by carbonaceous restriction without any benefit, but the restriction had not been at all rigid, and there was little doubt that, such as it was, it had been evaded. Physical exercise to any valid extent was out of the question. Accordingly, it was decided to

¹ *Clinical Medicine*, New Syd. Soc., vol. i. p. 40.

try the effect of a seton. This was inserted in the right infra-mammary region and worn for seven months, when it ulcerated through. While the seton remained in position, the attacks became steadily less in severity and frequency. After it had ulcerated through, they became in the course of a few weeks as bad and as frequent as ever. A fresh seton was inserted five months later, and again the attacks became less frequent and severe. The patient now informed Dr. Hawkes for the first time that she had suffered for as long as she could remember from what, from her description, was undoubtedly chronic post-nasal catarrh : that this affection had commenced to disappear about one month after the insertion of the first seton : that it had completely disappeared during the succeeding month : that it had reappeared about two months after the first seton had worked out ; and that it had again disappeared completely since she had worn the second seton.

§ 773. It is worth considering whether the great (and increasing ?) prevalence of post-nasal adenoids is not largely due to hyperpyraemia, or to the causes of hyperpyraemia. These growths are rarely congenital ; nor do they usually appear until some time after weaning, until, that is, excessive carbonaceous intake has become probable ; and I believe I am correct in saying that there is a growing conviction, that ' pap-feeding ' is at the root of this affection. Many children who suffer from adenoids suffer also from some form of recurrent or chronic bronchitis, or asthma. The growths have been regarded as factors in the chest affections ; and they have been removed on these grounds sometimes with benefit to the latter, but more often without any distinct result. It seems more reasonable, therefore, to refer both the bronchial and post-nasal affections to hyperpyraemia, or to some of the causes of hyperpyraemia ; and this view is supported by the results of acarbonizing treatment. Many cases of chronic bronchial catarrh in children may be completely dispersed by restriction of the carbonaceous intake ; and in some cases in which adenoid disease was present at the same time, the growths were found to shrink materially and progressively. Moreover, the obstructive and other symptoms of adenoids may often be observed to abate very markedly during an intercurrent pyrexia ; and it is perhaps significant that many writers have considered this affection to be a manifestation of the uric acid, or arthritic, diathesis¹ (Haig).

Many cases of chronic enlargement of the tonsils depend upon long recurrent subacute inflammatory attacks ; and sub-

¹ *Uric Acid in Disease*, A. Haig, 1897, p. 325.

acute tonsillitis may accompany many affections which we are regarding as manifestations of hyperpyraemia. At the onset of menstruation there is a tendency to hyperpyraemia ; and Dr. Helen McMurphy¹ found that, of 100 cases of healthy women, eighteen suffered generally or occasionally from subacute tonsillitis during menstruation. Subacute inflammatory conditions of the tonsils have been observed to precede acute rheumatism ; and the local affection has been regarded as the point of inoculation of the general disease. But if, as suggested, hyperpyraemia is a factor in acute rheumatism, it would seem more probable that both affections are manifestations of the same blood-state.

CHRONIC BRONCHIAL CATARRH OR CHRONIC BRONCHITIS

§ 774. Chronic bronchitis may originate in many ways. Reference has already been made to a typical case, described by Harry Campbell, in which the starting-point was an attack of acute bronchitis (§ 662). But the starting-point may be typical 'spasmodic' asthma : throughout Salter's monograph may be found abundant evidence that spasmodic asthma tends almost inevitably in the long run to pass into chronic bronchitis. Other cases again are chronic bronchitis from the commencement. A slight pharyngeal catarrh, succeeded by a slight tracheal catarrh and later by a slight catarrh of the larger bronchi, may commence and progress so insidiously that the patient cannot assign even an approximate date to his first departure from health. The latter cases more than others are apt to be ascribed to the 'gouty diathesis' : they may never pass beyond the stage described, especially if acute gout or some other efficient acarbonizing process intervene : they may become complicated by asthmatic paroxysms ; or they may graduate into developed chronic bronchitis, with all the complications, degenerative and other, which ultimately ensue.

It will not, I think, be difficult to show that in many cases of chronic bronchitis, whatever their mode of origin, the factor of hyperpyraemia is important, if not essential.

§ 775. FLUCTUATIONS IN THE CARBON CONTENTS OF THE BLOOD.—The most typically catarrhal bronchitis is subject to

¹ 'Physiological Phenomena of Menstruation,' *Lancet*, October 5, 1901, p. 910.

the same laws of exacerbation and remission as is the most typically nervous asthma. The daily, monthly and other fluctuations in the carbon contents of the blood influence conspicuously the symptoms of chronic bronchitis, just as they do the symptoms of paroxysmal asthma, and they do so in a parallel manner. Chronic bronchitis is better in the forenoon when combustion is rising, worse during the small hours of the morning when combustion is falling or low. It is better after prolonged abstention from food, worse shortly after a meal, especially after a heavy meal, and more especially after a heavy late meal, above all, when this is succeeded by sleep. Chronic bronchitis undergoes distinct exacerbation at the time when menstruation is impending; and the exacerbation is more marked if anything intervenes to prevent the flow. On the other hand, there is a remission of symptoms when the flow is well established or re-established. The climacteric tendency to hyperpyraemia is not without influence. I have notes of several cases in which a pre-existing bronchitis became much aggravated at the menopause. And Tilt says:¹—‘In four of my cases, habitual bronchitis dated from the change of life, and seemed to have been caused by it; and Borden has noted similar cases.’

§ 776. OTHER HYPERPYRAEMIC AFFECTIONS.—Chronic bronchitis like asthma is a common complication of constitutional states which are frequently associated with, if they do not all depend upon, hyperpyraemia: such are rickets, abarticular gout, some forms of renal disease, the scrofulous and tubercular diatheses and anaemia.

§ 777. PHYSIOLOGICAL ACARBONIZATION. — Chronic bronchitis may be observed to undergo marked improvement, or even to disappear, under conditions which add to the rate of physiological acarbonization.

I know of one case in which an habitual slight bronchial catarrh disappeared completely during *pregnancy*, though it is only fair to say that in others pregnancy has aggravated chronic bronchitis.

The clearing up of a chronic bronchitis is frequently concurrent with a marked increase in the *deposition of fat*, or with the commencement of obesity. One of my cases had been thin all his life. At 39, he had an attack of acute bronchitis

¹ *Change of Life*, 1882, p. 289.

which became chronic and lasted until he was 44. About this time, he commenced to grow stout and the bronchitis disappeared. He is now 50, weighs $15\frac{1}{2}$ stone, and remains absolutely free from all catarrhal affection, indeed he is in perfect health. The inverse relation between bronchitis and fat-formation hardly requires illustration: probably most practitioners who have practised for many years in the one district will be able to recall cases in point. The amenability to dietetic treatment of chronic bronchitis in the obese is very marked in comparison with its amenability in those who are thin. This is of great importance in prognosis.

§ 778. PATHOLOGICAL ACARBONIZATION.—Chronic bronchitis is often greatly ameliorated, sometimes dispersed, by the intervention of efficient pathological acarbonizing processes, whether these depend upon hyperpyraemia, or are merely incidental. This has been observed, but chiefly in the case of the prevention of an attack of acute arthritic gout. But pyrexia of any kind may have a similar salutary influence. I have seen considerable improvement follow the development of an attack of broncho-pneumonia in a chronic bronchitic: in several cases dengue, in two phthisis, acted similarly.

A stout man of 48 suffered from chronic bronchitis and from haemorrhoids which at times bled furiously. Each attack of bleeding was associated with marked temporary improvement in the bronchial affection. Whitehead's operation was then performed. After recovering from the operation (which gave immediate relief from the bronchitis, doubtless through haemorrhage and low diet), his chest affection became progressively worse, until relieved by dietetic treatment and systematic exercise. The alternation between haemorrhoidal haemorrhage and the distress of chronic bronchitis may frequently be observed.

The onset of diabetes completely dispersed habitual bronchitis in three cases; and in chronic bronchitics who suffer also from attacks of some of the paroxysmal neuroses, the relations between the two disorders are mainly those of alternation.

Chronic bronchitis may, on the other hand, replace recurrent pathological acarbonizing processes. Harry Campbell says: ¹—‘A man who for years had suffered on and off from arthritic

¹ ‘Observations on Diet,’ *Lancet*, 1902, May 31, p. 1556.

gout suddenly developed bronchitis : thereafter, his arthritis disappeared once for all, while the bronchitis continued on and off till his death.'

§ 779. RELATIONS BETWEEN CHRONIC BRONCHITIS AND ASTHMA.—It is certain that these apparently diverse clinical conditions may be combined in every proportion—that all intermediate gradations are to be observed between them. This fact seems a serious stumbling-block in the path of those who accept the view that the mechanism of asthma consists of a spasmotic constriction of the bronchioles by means of the circular muscular fibres of these tubules. Salter fully recognized the fact of the intermediate gradations, also the difficulty of explaining them. His preconviction in favour of the bronchial constriction theory led him to what now seems an unnecessarily complex explanation, namely, that in some cases bronchitis leads to reflex spasm of the bronchioles and so to asthma, but that in others a primary bronchial constriction, manifesting itself as spasmotic asthma, leads to, and becomes complicated by, bronchial catarrh. He says:¹—‘ My own belief is that severe chronic bronchitis never exists without asthmatic complication more or less ’; and he regards much of the dyspnoea of acute bronchitis as due to this same asthmatic spasm.²

But we have seen reasons for thinking that in the purest forms of paroxysmal asthma, even in those which depend upon an extrinsic exciting cause such as hay-asthma, the anatomical condition is a vaso-dilation of the bronchial area. Clearly this is true also of chronic bronchitis. For here, as in asthma, everything which causes cutaneous vaso-constriction intensifies the dyspnoea ; and everything which causes cutaneous vaso-dilation relieves the dyspnoea. The differences are of degree. In paroxysmal asthma, the vaso-dilation is sudden, severe, and evanescent : in chronic bronchitis, it is gradual of onset, of moderate intensity, and of long duration, or permanent. And between these two extremes there exists an unbroken series of cases presenting these features in all degrees of combination : it is impossible to draw between the members of the series any but purely arbitrary lines of demarcation. Of course the factor of bronchial constriction cannot be definitely excluded in any case ; but its importation seems unnecessary, since vaso-

¹ *On Asthma*, 1868, p. 128.

² *Ib.* p. 127.

dilation of varying degree will explain all cases, and is more consistent with the aforesaid series of clinical gradations.

Conformably, we find that the modifications of the respiratory rhythm in asthma and chronic bronchitis are identical after making due allowance for the variations of degree. In asthma, inspiration is short, precipitate, and attained through violent muscular exertion: expiration is prolonged, deliberate, and attained merely through elastic recoil, which is permitted by a partial and cautious relaxation of the inspiratory muscles. I have carefully watched many paroxysms of asthma, and have never detected evidence of muscular action on the part of the expiratory muscles, except during coughing, and then such action has been feeble and inefficient. Further, the pause between the two respiratory acts occurs at the end of inspiration, and not at the end of expiration as in normal breathing. This is obviously due to the necessity for maintaining patent the lumina of the tubes, narrowed by the swelling of the mucosae.

All the above modifications of respiratory rhythm may be observed in chronic bronchitis. But in chronic bronchitis the swelling of the mucosae tends to be permanent. Hence the compensatory chest expansion tends to be permanent. And Harry Campbell says: ¹—‘Observe the chest of a chronic bronchitic past middle life, and you will always find that it is more or less fixed in the inspiratory position.’

We may conclude that asthma and chronic bronchitis are, in many cases, varying bronchial manifestations of hyperpyraemia. Asthma is intermittent probably because it is severe and results in efficient acarbonization: chronic bronchitis is more or less continuous probably because it is inefficient as an acarbonizing process, whether this has been so from the commencement (chronic bronchitis commencing insidiously), or whether it has become so through the progressive deterioration of the acarbonizing machinery (chronic bronchitis resulting from recurrent asthma). The relation of chronic bronchitis to recurrent asthma—and to some cases of recurrent acute bronchitis—is the relation of some cases of chronic headache to recurrent headache, of chronic articular gout to acute recurrent gout, and of many chronic affections to many recurrent affections of allied morphology. In other words, many chronic affections are

¹ *Brit. Med. Journal*, October 12, 1901.

chronic because they have ceased to be, or because they never were, self-curative—because they are but inefficient acarbonizing processes.

The graduation of asthma—which affection we have accepted in many cases as a manifestation of hyperpyraemia and as an acarbonizing process—into chronic bronchitis constitutes not unimportant evidence that the latter condition depends in some cases upon hyperpyraemia.

§ 780. TREATMENT, DIETETIC AND OTHER.—The influence of diet was clearly demonstrated in the following case:—A resident of Brisbane, aged 34, while at home enjoyed perfect health, but was in the habit of paying frequent visits to Sydney. In that city, he invariably developed a moderate, but quite distinct, catarrhal condition of the nares, anterior and posterior, pharynx, larynx, and larger bronchi. The catarrh persisted so long as he remained in Sydney. Not unnaturally he explained it by the relatively greater humidity of the atmosphere in the southern capital. It was pointed out to him, however, that there was an alternative explanation. While in Brisbane, he lived very plainly at his own home: while in Sydney, he lived at a large cosmopolitan hotel where the greater variety on the bill of fare led him to live much more generously. Being interested in the cause of his complaint, he undertook to solve the question. On his next visit to Sydney, he adhered rigidly to his home diet, both as regards kind and quantity; and for the first time suffered from no catarrh whatever.

M. Huchard¹ has recently described two cases of bronchitis which, according to my view, must be regarded as typical cases of hyperpyraemic bronchitis. The patients were from 35 to 40 years of age, and presented ‘identical morbid phenomena, the etiology of which might at first seem obscure, and in which an error of pathogenic interpretation might have led to a serious therapeutic one. For about ten years, they had repeated attacks of bronchitis with pulmonary congestion: cough was incessant, and was accompanied by a viscous expectoration. All the usual remedies for bronchitis had been tried without success. The treatment which produced a striking improvement was as follows:—(1) A milk and vegetarian diet—two pints of milk per day, little meat, much vegetables. (2) Drinking in the morning, fasting, a large glass of Evian water,

¹ *Journ. des Practiciens*, June 30, p. 421, quoted in the *Medical Review*.

twenty minutes afterwards, a second glass, and in another twenty minutes, a third glass. With the first glass, a 7-gr. cachet of theobromine was taken, and with the second, a small dose of lycetol. (3) Every day, or every other day, general and methodical massage was practised. (4) Plenty of exercise in the open air. The dominant condition, the bronchitis, was not specially treated.' The writer goes on to point out that 'there are two varieties of medication—symptomatic and pathogenic. For the symptom of cough, whatever the cause may be, there are opiates and belladonna, for abundant expectoration, there is turpentine, for heart affections, digitalis. If no improvement takes place, the medicine is discredited. Pathogenic medication, the method of the future, is directed, not against the symptom, but against the cause of the symptom. In these two cases, the dominant condition was bronchitis, against which symptomatic medication had completely failed. These two patients were the subjects of the uric acid diathesis. When the elimination of uric acid is complete, the general state is good, but if the renal filter does not fulfil its functions, uric acid accumulates in the tissues. Such patients often present the phenomena of "alternating urines." During periods of ten or fifteen days the urine is abundant and clear, and contains very little uric acid. The health is then usually defective. Afterwards, the urine becomes scanty, muddy and brick-red: there is a veritable downfall of uric acid, which is accompanied by a cessation of the morbid phenomena.'

Concerning these two and similar cases, M. Huchard takes the view, so widely entertained at the present day, that the catarrh depends upon the toxic influence of uric acid retained and circulating in the fluids of the body, or upon its irritative action, when deposited in the respiratory mucosae: in proof whereof, he points to the inverse relations between the severity of the symptoms and the uric acid output. But, without in the least seeking to discredit any of M. Huchard's facts—indeed, on the strength of them as they stand—we may take a widely different view. We may believe that both the bronchitis and the uric acid retention were co-results of hyperpyraemia; and that both the respiratory relief and the releasement of the uricaemia through increased renal excretion of uric acid were co-results of acarbonization. This view fully explains the favourable results of the adopted treatment, of which the

essential items doubtless were (1) the extremely low proteid intake which reduced digestion and absorption and, therefore, the carbonization of the blood ; and (2) the massage and open-air exercise which increased the decarbonization of the blood.

§ 781. The line of treatment which, in my experience, is the most rapidly effectual in chronic bronchial catarrh and chronic bronchitis depending on hyperpyraemia, consists in a plentiful supply of fresh air, day and night, moderate but systematic physical exercise, together with a due limitation of the carbonaceous intake : in short, the open-air or sanatorium treatment for consumption, *plus careful dieting*. This, at least, applies to Queensland : it may not of course do so in its entirety to less hospitable climates. As a result of my experience (which is now somewhat extensive), I have come to the conclusion that chronic bronchitis, *uncomplicated by thoracic deformity and gross organic changes in the bronchial and pulmonary tissues*, is one of the most amenable of all the chronic hyperpyraemic disorders to properly selected acarbonizing treatment ; and this, even in many cases which are of long standing.

Oxygen inhalation has been found of use in bronchial affections. Dr. Samuel S. Wallian treated twenty-four cases of subacute and chronic bronchitis : thirteen of these cases were cured or fully relieved : eight were sensibly relieved ; and three were little or not at all relieved.¹

SPECIAL FORMS OF CHRONIC BRONCHITIS

§ 782. There are two special forms of chronic bronchitis which are sometimes separately classified, but which are probably only modifications of the commoner forms, namely (1) chronic purulent bronchorrhoea, unaccompanied by dyspnoea or wheezing but accompanied by profuse purulent or semi-purulent expectoration ; and (2) dry bronchitis, unaccompanied by expectoration but accompanied by incessant and useless cough.

Of the first, I have seen one case in a very fat girl which, although of between two and three years' duration, yielded very rapidly to a moderate degree of carbonaceous restriction

¹ *Oxygen and other Gases in Medicine and Surgery*, pub. F. A. Davis, 1889, p. 240.

(Case LXVIII). Of the second, ascribed by M. Huchard¹ to uric acid, I have seen several examples; and all proved more or less amenable to acarbonizing treatment.

SUMMARY

§ 783. It is argued in this chapter that many chronic catarrhal conditions have hyperpyraemia for an essential factor; and that the dispersion of hyperpyraemia, whether by pathological or physiological means, not infrequently results in the complete cessation of such catarrhs.

¹ *Journ. des Practiciens*, June 30, p. 421, quoted in the *Med. Review*.

CHAPTER XXI

§§ 784–818

Unrelieved hyperpyraemia (*cont.*)—Nervous manifestations—Neurasthenia: food: variations in combustion and carbon contents of the blood: pathological acarbonizing processes: blood-pressure: the Weir-Mitchell treatment—Disturbances of vision: food: physical exercise: menstruation: paroxysmal neuroses, etc.: acute gout and pyrexia: plumbism—Psychical manifestations: insanity: food: daily fluctuations in combustion: menstruation: pregnancy and lactation: fat-formation: pyrexia: migraine: asthma, hay-asthma and chronic bronchitis: epilepsy: haemorrhage: glycosuria: insanity and blood-pressure: plumbism: morbid anatomy: humoral views of other writers—Causes of insanity, other than hyperpyraemic, and other than humoral—Summary.

§ 784. As with the respiratory, so with the other manifestations of unrelieved hyperpyraemia, the nature of the special phenomena and their localization seem to depend often upon some previous acarbonizing process of prolonged recurrence. Of migraine, Anstie says:¹—‘The fact on which I would most particularly insist, is one that was first taught me by my personal experience, viz. that migraine is, with extraordinary frequency, the primary or youthful type of a neuralgia which, in later years, entirely loses the special characters of sick headache, and assumes those of ordinary frontal neuralgia, with or without complications. In my own case, the “sick-headache” character of the affection was strongly marked during the first two or three years, after which it gradually lost all tendencies to stomach complication, and, what is more, the type of the recurrence became entirely changed. Yet it is quite impossible to believe that the malady is now a different one, in any essential pathological point, from what it was at first.’

I have seen several cases in which typical migraine in early life has graduated later into various forms of facial neuralgia. Of course I am not suggesting that in all such cases there remains

¹ *Neuralgia and its Counterfeits*, 1871, p. 121.

a condition of unrelieved hyperpyraemia. In many no doubt the neuralgic attacks have become pathologically prepotent, and continue to recur in response to a mere relative hyperpyraemia : such may be regarded as the persistence of migrainous rhythms which have been impressed upon the memory of the body. What happens naturally in the course of years, may happen through acarbonizing treatment in the course of weeks. In certain cases, acarbonizing treatment fails to disperse all the symptoms of recurrent migraine, but introduces modifications therein. These consist usually in the cessation of the digestive symptoms, the vomiting, and perhaps the anorexia—those symptoms which secure acarbonization—while the headache and perhaps some of the visual symptoms continue to recur (compare § 535). In such cases, cessation of acarbonizing treatment results in the reappearance of the digestive symptoms along with the attacks.

In many cases, however, there remains an actual hyperpyraemia. Not infrequently, recurrent or chronic neuralgia, which is a legacy from recurrent migraine, may be completely dispersed by measures which promote acarbonization, pathological, physiological, or therapeutic. Restriction of the carbonaceous intake plus increased physical exercise is often most successful (Case XVI) ; and Broadbent says :¹—‘ I have . . . seen neuralgia cured by a dose of calomel when all other remedies, including change of air, had failed to give relief.’ In such cases, it is reasonable to assume that the ‘wearing out’ of the recurrent pathological acarbonizing process has left a condition of more or less unrelieved hyperpyraemia with neuralgic manifestations.

And so with other cases. In one of severe gastralgia, the paroxysms beginning at puberty recurred at first every twelve months, later every six months, then every three months, every month, every fortnight, and so on. As they became more frequent, so they became less severe, and finally terminated in a condition of continuous gastric pain, with slow high-tension pulse, emaciation, and all the symptoms of anorexia neurosa. The case was then mistaken for chronic gastric ulcer, but the diagnosis of unrelieved hyperpyraemia, arising, *inter alia*, through the decreasing efficacy of the acarbonizing paroxysms, was, I think, borne out by the results of treatment. Recovery

¹ *The Pulse*, 1890, p. 177.

was complete after rather prolonged Weir-Mitchell treatment, combined with a more than ordinary degree of carbonaceous restriction in the early stages (Case XLVII).

NEURASTHENIA

§ 785. There is an increasing tendency to refer many of the clinical conditions grouped under the term 'neurasthenia' to humoral causes : thus we hear frequently of toxic, lithaemic, and gouty neurasthenia. But it seems highly probable that the humoral basis for *some* of the cases so designated consists of hyperpyraemia.

§ 786. FOOD.—Most of the cases of neurasthenia which have come under my notice have been amongst women, and in the great majority of these, there has been a marked deficiency of proteid in the diet. Frequently this has arisen through poverty, as in the case of hard-worked needlewomen in large towns ; and I am sure that the long-continued drought in Queensland and New South Wales is indirectly responsible for many cases of neurasthenia, through the consequent high price of meat. But in many cases—and this applies more especially to the well-to-do—the female temperament is directly responsible. Of certain women, Clifford Allbutt says:¹—‘Eating seems to them a crass matter : meat, even the smell of it, makes them sick. . . . Gradually the appetite neglected begins to disappear.’

It has been argued that a deficiency of proteid will tend to reduce the decarbonizing capacities of the tissues, katabolic and anabolic, and the oxygen-carrying power of the blood (§ 249), as well as the carbonizing capacities of the digestive organs: hence it may easily happen that a carbonaceous intake which is actually small may be relatively large and lead to hyperpyraemia.

§ 787. VARIATIONS IN COMBUSTION AND CARBON CONTENTS OF THE BLOOD.—We have seen that during the diurnal cycle there is a regular fluctuation in the rate of combustion (§ 111); and we have inferred a corresponding inverse fluctuation in the carbon contents of the blood (§ 300). Conformably, an article in the ‘Medical Press’ for May 29, 1901, refers to a concurrent fluctuation in the severity of the symptoms experienced

¹ *A System of Medicine*, vol. iii. p. 475.

by some neurasthenics. The symptoms are most severe in the morning on awakening: thenceforward to noon, there is a gradual improvement: at bed-time, the patient is at his best. We have seen similar fluctuations, similarly explicable, in the tendency to paroxysmal neuroses (§ 311 *et seq.*) ; and presently, we shall note the same in some cases of insanity (§ 801).

Physical exercise, one of the most effectual methods of physiological decarbonization, is markedly deficient in the recent history of many neurasthenics; and its enforcement, together with appropriate food, is often sufficient for cure. Such cures, however, seem more frequently accidental than deliberate. The following case, described by Goodhart,¹ is, I imagine, an example. ‘An officer in the army ascribes all his ailments to overwork in preparing for examination. At any rate, he never afterwards felt well, and when summoned to go abroad in the Boer war he was so limp that he could hardly put one foot before the other. Yet when in it, he bore himself so that his enemies had a care for him, and he seems to have obtained both health and credit. But as soon as he came home, expecting to remain well for the future, he speedily fell back into his old limpness, in which he suffers badly from depression: his bowels became obstinately constipated: he could not think: he could not remember: he could not even write his letters sometimes, for his hand seemed to forget its cunning.’

Others, though they do not recognize the humoral condition hyperpyraemia, are in substantial agreement with regard to the influence of deficient combustion. ‘Wiederhold² believes that the cause of neurasthenia lies in deficient metabolism in the nervous system, slow blood changes, and venous stasis, brought about through insufficient respiration and weak heart-function. As a result, there is oxygen hunger of the tissues of the nervous system.’ This author lays stress upon oxygen inhalation, and has found the best results in pale obese neurasthenics. Deficient combustion depending on anaemia (§ 105) is remedied with comparative ease; while, as so frequently insisted upon, the existence of a well-developed fat-forming capacity is of material assistance in dispersing hyper-

¹ *Lancet*, May 9, 1903, p. 1285.

² *Medical Annual*, 1899, p. 412.

pyraemia in all cases. Dr. Samuel S. Wallian¹ reports twenty-one cases of neurasthenia treated by oxygen inhalations: eleven of these were cured or fully relieved: four sensibly relieved; while six were little or not at all relieved.

§ 788. PATHOLOGICAL ACARBONIZING PROCESSES.—Many neurasthenics have suffered in the past from one or more pathological acarbonizing processes of many years' recurrence, indicating a prolonged struggle on the part of the organism against hyperpyraemia. I have referred to a case of recurrent gastral-gia which led up to severe anorexia nervosa (Case XLVII); but ordinary bilious attacks, migraine, and even acute pyrexial gout, are to be found in the histories of neurasthenic patients. Usually, as in the gastral-gic case just referred to, the recurrent acarbonizing process has ceased to recur, at any rate in an efficient form, before the full development of the chronic condition: I have several times seen the paroxysms of migraine become far less marked, though perhaps more frequent, as the irritability and prostration of neurasthenia advanced; and it will be admitted that the general condition in many cases of chronic apyrexial articular gout is not far removed from neurasthenia. On these grounds, then, it is reasonable to regard the decreasing efficiency of pathological acarbonization as a factor in the development of what may be termed 'hyperpyraemic neurasthenia.'

§ 789. BLOOD-PRESSURE.—Hyperpyraemia, we have seen, may manifest itself by general high blood-pressure (§ 727 *et seq.*); and it is certain that in many neurasthenics, though by no means in all, the pulse presents the characters of high tension. 'The study of arterial tension in neurasthenia . . . is mentioned by Charles Lewis Allen² in his paper on "Arterio-Sclerosis in its Relation to the Nervous System"; and Fleury, in his report to the Academy of Medicine, describes a neurasthenia with low tension, to be benefited by rest and tonics, and another neurasthenia, complicated with symptoms of gout, lithaemia, alcoholism and diabetes, in which the tension is high and which is curable by the elimination of toxins by exercise, a lacto-vegetarian diet, purgatives and diuretics.' It need not be admitted that a low-tension pulse excludes a hyperpyraemic

¹ *Oxygen and other Gases in Medicine and Surgery*, pub. F. A. Davis, 1889, p. 240.

² *Progressive Medicine*, September 1902, p. 128.

origin ; still it is with the latter of the two varieties of neurasthenia that we are mainly concerned. Alcohol is probably a common factor of hyperpyraemia : gout, lithaemia, and diabetes, as well as high arterial tension, are conditions which we are ascribing in many cases to hyperpyraemia, or to the causes or results of hyperpyraemia ; and exercise, a lacto-vegetarian diet, and purgatives tend in various ways to promote acarbonization of the blood. As regards diuretics—medicinal diuretics, that is to say—their influence upon neurasthenia must, I think, be considered doubtful. This does not of course apply to diuretics, such as calomel (§ 245), which also tend to cause acarbonization of the blood through purgation.

§ 790. THE WEIR-MITCHELL TREATMENT.—The marked success of the Weir-Mitchell method of treatment seems to me the strongest evidence that many cases of neurasthenia own a hyperpyraemic factor. The treatment commences with a short fast, after which nothing but milk, a lowly carbonaceous and highly nitrogenous diet, is allowed for a week or so, and this in moderate quantities. During this period, the carbonaceous excess has time to disappear from the blood under the influence of the retarded combustion processes of the neurasthenic organism ; while fresh accumulation is obviated. Influenced by these views, I have frequently substituted for the milk, during the period of under-feeding, a still more lowly carbonaceous and highly nitrogenous diet, such as some modification of the Salisbury diet, or a purely proteid food-stuff such as plasmon ; and, I think, with equally good and even more rapid results. My own experience, even before I had framed any theory on the subject, led me to the conclusion that the initial period of under-feeding, or rather of reduced carbonaceous feeding, is a most important part of Weir-Mitchell's method of treatment ; and I have on several occasions failed to make a satisfactory start through laying too little stress thereon.

While the carbonaceous income is thus restricted, expenditure is increased by massage and electricity. Weir-Mitchell points out that both of these therapeutic measures cause a rise in the body temperature, massage¹ a rise averaging 2° to 6° F., or even more, electricity² a 'much more constant and remarkable' rise. Commenting upon these thermal phenomena, he says :³—'It is impossible to observe the increase of heat which

¹ *Fat and Blood*, 1900, p. 96 et seq.

² *Ib.* p. 110.

³ *Ib.* p. 94.

follows both massage and electricity, without inferring that these agents must for a time, like exercise and other tonics, increase the tissue-waste by the stimulus they cause of the general and interstitial circulations, and by the direct influence they seem to have on the tissues themselves.' By whatsoever means they act, there can, I think, be no question that both massage and electricity, as employed in this treatment, increase the rate of combustion or katabolic decarbonization by the nitrogenous tissues. Further, both measures probably promote cutaneous vaso-dilation : with massage, indeed, the skin 'is visibly flushed as . . . by ordinary active exercise.'¹ Conformably, Leonard Hill points out that 'massage of a considerable muscular area produces a fall of general arterial pressure. . . . This fall may amount to one-fifth of the initial pressure.'² Since heat loss is augmented, the increase of temperature which follows massage is attained in spite of this loss. Consequently, the increase in the rate of combustion, which is responsible for the rise of temperature, must be considerable.

There seems no doubt that one important factor in the increased combustion rate is an increase in the oxygen-carrying power of the blood. 'Dr. J. K. Mitchell³ in 1894 made a large number of examinations of the blood before and after massage, some in patients under treatment for a variety of disorders affecting the integrity of the blood, and a few in perfectly healthy men. With scarcely an exception, there was a large increase in the number of corpuscles in a cubic millimetre, and an increase though of less extent in the haemoglobin content. Studies made at various intervals after treatment showed that the increase was greatest at the end of about an hour, after which it slowly decreased again ; but this decrease was postponed longer and longer when the manipulation was continued regularly as a daily measure.' Weir-Mitchell is inclined to think that a part of the increase in the number of corpuscles is due to a number of unoccupied cells being called into the circulation 'by the necessities of increased circulatory activity brought about by massage.' He adds :⁴—'If this is the first effect, yet as it is observed that the increase of corpuscles, at first passing, soon becomes permanent, we must conclude that

¹ *Fat and Blood*, 1900, p. 99.

² *Text-book of Physiology*, Schäfer, vol. ii. p. 155.

³ *Fat and Blood*, 1900, p. 101 *et seq.*

⁴ *Ib.* p. 103.

massage has the ultimate effect of stimulating the production of red corpuscles.'

Eventually, as a combined result of the diminished income and the increased expenditure, the appetite begins to reappear. Food of all kinds is then steadily increased, until in some cases enormous quantities may be ingested, digested, absorbed and successfully metabolized. Whether as a result of the increased proteid supply or through other items in the treatment, a marked increase in the anabolic decarbonizing capacities of the nitrogenous tissues is added to their increased katabolic decarbonizing capacities. Thus is the organism still further ensured against hyperpyraemia, and a conspicuous increase in the deposit of fat is attained.

§ 791. The pre-eminent success of the treatment in appropriate cases, is, it seems to me, explained by a decided increase of function generally, whereby the organism is enabled to deal with physiologically, and benefit from, a generous dietary. But to my mind excessive quantities of food, especially of the purely carbonaceous food-stuffs, are unnecessary and, unless accompanied by proportionately rapid fat-formation, retard convalescence by creating a demand for pathological acarbonizing processes. Weir-Mitchell says: ¹—‘ Nearly always at some time in the progress of the case, there are attacks of dyspepsia, when it suffices to cut down the diet one-half, or to give milk alone for a day or two.’ Such dyspeptic attacks are, in my opinion, for the most part examples of secondary dyspepsia : they do not depend upon any immediately antecedent qualitative error of diet, but upon a margin of carbonaceous material in the blood over and above the decarbonizing capacities of the tissues. Thus there occurs a tendency to hyperpyraemia, succeeded and amended by glycogenic distension of the liver. Hence in some cases these attacks may be almost regularly recurrent : they may pass beyond mere dyspepsia and amount to frank bilious attacks, with vomiting and sometimes diarrhoea ; and they demand, as pointed out by Weir-Mitchell, a reduction in the quantity, not an alteration in the quality, of the food (compare § 78).

Weir-Mitchell says: ²—‘ As a rule I find it harder to feed and fatten persons at rest during our summer heats.’ This is in accord with my experience in the tropics and subtropics

¹ *Fat and Blood*, 1900, p. 144.

² *Ib.* p. 53.

south of the line. It is easy to see that high external temperature will add to the difficulty of promoting increased combustion and render such less tolerable if attained. But since realizing the importance of regulating the fuel supply, I have, by restricting the initial dietary more closely to proteid, obtained better success in summer: such, however, are not to be compared with the results which are obtainable in winter.

DISTURBANCES OF VISION

§ 792. There can, I think, be little doubt that pyraemic conditions are capable of exerting a marked influence upon the acuity of vision. This was first suggested to me by a personal experience.

§ 793. Food.—The writer had been presbyopic for two years and required glasses for reading in the evening. He was testing the effect upon himself of an almost purely proteid diet. After about twelve days of this diet, during which time he had lost 8 lbs. in weight, his vision returned practically to its original standard. This result was altogether unlooked for, and it was the more striking on account of the manner of its discovery. He suddenly remembered that for over a fortnight he had forgotten to use his glasses, and this although he was doing much reading and writing every evening until late hours. The improved vision continued for some weeks after he returned to an ordinary mixed diet, and then gradually disappeared.

Since the above personal observation, I have made many inquiries as to the influence of food upon sight; and I find that a distinct relation between the two is recognized by many of the more observant members of the general public.

A lady of 50 informs me as a result of her own observations, made long before I called her attention to this subject, that the acuteness of her vision for the first few hours in the morning is markedly dependent on her food of the day before, more especially upon that which is taken in the evening. With a small evening meal at 6.30 P.M. and nothing later, her morning vision is at its best: with a hearty dinner, it is worse; but with supper just before bedtime, it is worst of all. The articles of diet she has found most prejudicial are stout and any form of sugar: a few chocolate creams late at night have a marked effect; and all this without the least

discomfort in other ways, and without the least loss of appetite for breakfast.

The influence of food is noticeable in persons who suffer from visual disorders other than presbyopia.

A patient whom I treated for simple obesity is markedly myopic. After two or three weeks of dietetic treatment, he informed me, without suggestion on my part, that his sight had greatly improved. His attention was called to this fact through noticing that he was then able for the first time to read the name of a tramcar in time to signal it to stop.

George Keith says: ¹—‘I am told that it is now well known that high living is fatal to good shooting.’ And the following remarks by George Wherry ² are interesting and may have a high significance:—‘In many cases of incipient cataract occurring in adults, it has been my practice during many years to advise abstinence from, or the sparing use of, sugar in the diet, although most of these patients had urine entirely free from sugar. . . . There is plenty of scientific evidence that cataract may be formed by sugar when taken in excess by animals, and it seems quite probable that, in many cases, the consumption of sugar, though not injurious to the general health, may hasten the formation of cataracts. . . . Experiments on trout were made many years ago proving that cataracts in these fish were caused by sugaring the water in which they lived. Experiments more lately, both in fishes and frogs, give the same results. . . . Weir-Mitchell caused cataracts in frogs by the subcutaneous injection of sugar. . . . There is thus much evidence that excess of sugar in the system will bring about cataracts, and it seems probable that excess of sugar may occur without any evidence of ill-health or glycosuria. . . . In suitable cases, it will be found that the general health is improved by abstinence from sugar, and among my notes of several thousand cases of disorder of the eye, I find sufficient evidence to encourage me in the belief that the progress of cataract has been retarded by my advice.’

§ 794. PHYSICAL EXERCISE.—The following case, in that it was induced by the same conditions as ‘week-end asthma’ (§ 306) and was cured by proper open-air exercise, may, I think,

¹ *Plea for a Simpler Life*, 1897, p. 144.

² *Lancet*, October 18, 1902, p. 1079.

be regarded as one of 'hyperpyraemic amblyopia.' Dr. James Adam, the contributor, says: ¹—'A teacher, aged 24, who took little exercise, and spent most of his spare time in study, consulted me in July 1899. Vision : left, barely counts fingers : right $\frac{6}{60}$: no marked fundal change. Dr. Maitland Ramsay of Glasgow, to whom I sent the case, and to whom is due the credit of the cure, emphasizing the fact that the defect in the visual field was central, not peripheral and that there was persistent oxaluria, gave a hopeful prognosis. The patient was at first made to rest in bed in a dark room, and got pilocarpine injections and other eliminants. Later, he was allowed to go out with dark protection glasses and medicinal treatment (hyd. perchlor., ammon. chlor., pot. iod.) was continued. During the winter, vision became worse, so that he could not see the chairs in my consulting-room and stumbled against them. About a year after I first saw him, there was no improvement, and a well-known ophthalmologist in Edinburgh gave a very black prognosis, and said patient would never be able to read again. Shortly after this, strychnine having been added to the medicine, the patient thought he began to notice slight improvement : he could just see the largest test-types. Dr. Ramsay had pressed for a sea voyage. To this, patient was reluctant, but in July 1900 he went for a trip to Shetland. By the time he reached Kirkwall, he could see the town clock. On his return a few weeks later, distant vision was $\frac{6}{6}$. A trip to Canada completed the cure, and he could read the smallest print.' Dr. Adam adds: 'The importance of a sea voyage in quickening metabolism is obvious,' especially so, it may be added, in the case of a sea voyage to higher latitudes.

§ 795. MENSTRUATION.—The tendency to hyperpyraemia which we have inferred accompanies the onset of the menstrual period, is frequently associated with disordered vision. Dr. Helen McMurchy,² from a statistical inquiry into the normal symptoms of menstruation, states that a large number of women speak emphatically about the eyes being very tired and say they 'cannot read at night.'

§ 796. PAROXYSMAL NEUROSES, ETC.—In most cases of migraine, bilious attacks, etc., vision is in some degree impaired ; and such impairment may take many forms. Some forms (hemianopia, spectral appearances, etc.) seem to depend upon

¹ *Brit. Med. Journal*, May 9, 1903.

² *Lancet*, October 5, 1901, p. 910.

the vascular changes in the nervous centres or in the organ of sight, since they are limited to the time of the attack. But it does not seem to be generally known that an overt (that is, an effectively acarbonizing) neurosal attack of any kind is capable of improving for a time the acuity of vision. Yet I can have no doubt that such is the case. The dimness of vision associated with migraine and bilious attacks passes off with the paroxysm ; and many have assured me that their sight is keener during the succeeding week than at any other time : this increased keenness of sight is concurrent with the marked sense of well-being which is the rule during this period.

§ 797. ACUTE GOUT AND PYREXIA.—During the state of more or less unrelieved hyperpyraemia which, we have inferred, precedes the acute gouty paroxysm, the sense of sight is apt to suffer. Trousseau says :¹—‘A gouty man was complaining of his vision : his eyes, he said, seemed as if covered with a flake of snow. These sensations disappeared after an attack of gout in the foot.’

Pyrexia, other than that of the acute gouty attack, may have a similar influence ; and in some cases it would seem that the succeeding improvement may be permanent.

An old lady in her eightieth year is at the present time a patient of the Diamantina Hospital for Chronic Diseases : she suffers from chronic rheumatoid arthritis. At the age of 40, she began to be presbyopic and commenced the use of glasses. About once in five years the strength of these had to be increased. At the age of 72, so much had her sight deteriorated, that she practically gave up trying to read. She then had a succession of acute illnesses. The first was dengue fever, which was followed by prolonged convalescence. After this, she suffered from pleurisy with delirium. Then an attack of jaundice supervened ; and finally a series of attacks resembling intermittent fever. When she began to recover from these last, she was allowed to have her correspondence which had been accumulating for some time. To her surprise, she found that her sight was practically as good as ever in her life ; and it has slightly improved since. She can now read her newspaper and thread a needle without spectacles.

§ 798. PLUMBISM.—‘J. Pal points out that the one condition common to the temporary disturbances of vision which may occur in lead colic, uraemia, and eclampsia, is high blood-

¹ *Clinical Medicine*, New Syd. Soc., vol. iv. p. 397.

pressure, and not, as has been supposed, uraemia. For in lead poisoning and eclampsia, there may be no albuminuria or other sign of nephritis.¹ In eight cases of lead poisoning in which the fundus was examined, the amaurosis appeared during an attack of colic. The retina was normal in all but one in which there was spasm of the retinal arteries. Uraemic amaurosis of the transitory type with intact fundus usually occurs during the rise of blood-pressure which invariably precedes an attack of uraemia. In a case quoted, venesection reduced the blood-pressure from 210 to 170 mm., and vision returned. In puerperal eclampsia, transitory amaurosis may occur whether nephritis is present or absent. ‘But before the appearance of convulsions, there is constantly a rise of blood-pressure. Amaurosis frequently appears in this pre-convulsive stage. . . . Rarely, convulsions may be absent, the blood-pressure falling after the appearance of the amaurosis. The changes which produce transitory amaurosis are probably situated in the occipital lobes and consist . . . in contraction of the vessels.’²

The above argument tends to the view that hyperpyraemic disturbances of vision depend proximately upon vascular changes; but I cannot help thinking that in some the proximate factor is humoral.

PSYCHICAL MANIFESTATIONS: INSANITY

§ 799. A large number of published clinical observations may be cited which tend to show that insanity may own a factor in hyperpyraemia. In some cases, the psychical disorder may operate as an acarbonizing process. In melancholia, food is commonly refused, and this may be conservative, even though it prove eventually dangerous or even fatal. Acute mania, as already pointed out (§ 266), may reduce the carbon contents of the blood, both by restricting income and by increasing expenditure; in which connexion it may be significant to note that in some cases of prolonged melancholia, ‘the change of the symptoms to those of mania yields a better prospect of recovery’³ (Sankey). But in many cases the insanity can only be regarded as a manifestation of unrelieved hyperpyraemia.

¹ *Brit. Med. Journal*, Epitome, June 27, 1903.

² *Ib.*

³ *Lectures on Mental Diseases*, W. H. O. Sankey, pp. 133, 134.

The evidence in support of a hyperpyraemic factor in insanity may be thus generalized :—The association of insanity with efficient acarbonization, pathological or physiological, is for the most part one of alternation : the association of insanity with other manifestations of hyperpyraemia, or unrelieved hyperpyraemia, is for the most part one of concomitance. This evidence will now be considered in some detail.

§ 800. FOOD.—Amongst alienists it is commonly held that ‘insanity being a disease in most instances of low vitality, a full, nutritious, and easily digestible diet is of the first importance in its treatment’¹ (Needham). I am not concerned to dispute the general truth of this statement. It may be that in all cases insanity is a disease of low vitality ; but it by no means follows that such low vitality can invariably be raised by a full, nutritious, and easily digestible diet. It may be argued that low vitality implies, *inter alia*, low decarbonizing capacities, katabolic and anabolic, on the part of the nitrogenous tissues, and that a carbonaceous supply in excess of these expending capacities can tend but to increase the existing failure of function. And it is certain that most of the intercurrent disorders which, we shall see presently, have at various times been noted to initiate mental convalescence, cannot operate to increase the nutriment at the disposal of the cells, but must, on the contrary, diminish the available supply, while for the most part they increase materially the expenditure.

In the face of the prevalent conviction amongst alienists expressed above, it is not to be expected that many examples of the beneficial effect of reduction of food are to be found in medical literature ; and where such are found, the reduction or withdrawal has usually been accidental, not therapeutic. George Keith refers to a case in the following words :—‘A man had been in an asylum for the greater part of his life. From time to time he refused food, and it was put into his stomach by a tube. At last his health quite failed, so much so that it was considered useless to force food any longer upon him, and he was left to die in peace. He did not die, and more than that, he recovered his sanity, and was able soon to leave the asylum.’² And I have heard of a lunatic who escaped from his

¹ *Dictionary of Psychological Medicine*, Hack Tuke, Article on ‘Diet.’

² *Fads of an Old Physician*, 1897, p. 134.

asylum and wandered about for several days without food, recovering his sanity before he was found.

Speaking of the treatment of acute passive melancholia, H. de M. Alexander says:¹—‘Plenty of water, three or four pints of milk daily, the exhibition of an alkaline diuretic which does not disturb digestion—such as citrate of potassium—judicious attention to the bowels and confinement to bed, are all that are required in most cases. . . I venture to assert that it only requires the further experience and observations of others to prove that the *suraliment* method of treating acute passive melancholia is unphysiological.’ Again the same author says:²—‘As is well known, an attack of mania is usually ushered in by certain premonitory symptoms, and one of the commonest of these is mental depression. On the appearance of any of these premonitory symptoms, it is often possible to ward off the acute attack by confining the patient to bed amidst quiet surroundings and by *keeping him on a low diet.*’ (Italics mine.)

Although legally sharply differentiated, insanity and sanity graduate, as already urged, insensibly into each other: there is, for instance, every gradation between ordinary temporary depression of spirits and typical melancholia. And there is a well-marked clinical condition of which I have seen many examples and which may best be termed ‘post-prandial depression.’

An elderly gentleman came to me complaining of intense mental depression, recurring daily between the hours of 10 A.M. and noon. Although an abstemious man, he was strongly impelled to take alcohol in considerable doses at this time. Such symptoms are usually ascribed to dyspepsia, but mostly, I am convinced, without due cause. This patient had an excellent appetite, and, so far as could be judged from absence of symptoms, a powerful digestion. His breakfast consisted of porridge and milk with sugar, followed by eggs and bacon, or a chop or steak, also bread and butter and marmalade. The more depressed he became, the bigger the breakfast he ate, in order to ‘keep his strength up’: as a result, his depression became intensified further. He was ordered a lighter—that is, a less carbonaceous—breakfast: porridge, sugar, and bread were interdicted, and he was allowed either a small chop or steak, or one egg with a little bacon, together with not more than half an ounce of toast. The

¹ *Lancet*, July 5, 1903, p. 19.

² *Ib.* p. 20.

depression ceased concurrently with the alteration of diet, and has not returned.

The case is a type of many, the symptoms of which can, I think, only be ascribed to the irruption into the blood of fuel in excess of the capacities for physiological disposal.

But the nervous manifestations of post-prandial hyperpyraemia are not always those of depression and misery. Murchison regarded a feeling of insurmountable sleepiness after meals as a frequent symptom of ' lithaemia,' a term, I shall argue, synonymous with hyperpyraemia. The following is a case in point :—

A young medical man, resident medical officer of a large general hospital, suffered every forenoon from intense drowsiness, so much so that he found great difficulty in keeping awake, except when constantly moving. He was very thin, and was in the habit of taking a highly carbonaceous diet with a view to increase his weight; but although his appetite and digestion were good, he did not accumulate fat. His tendency to morning somnolence ceased on the day that he omitted from his breakfast porridge and sugar.

Post-prandial somnolence is, in my experience, most common after the midday meal, if this is at all heavy, least common after breakfast.

§ 801. DAILY FLUCTUATIONS OF COMBUSTION.—The daily fluctuations of the carbon contents of the blood, which, I have assumed, tend, other things being equal, to vary inversely with the daily fluctuations of combustion (§ 300), seem to have a marked influence upon the mental condition of the insane. It will be admitted that many, if not the majority of, asylum inmates are mentally worse during the night or in the early morning, at their best from midday and thereafter. Savage says of some cases :¹—‘ The depression is most marked in the very early morning, and persists until midday, when it slowly becomes less, and by six or seven o’clock has all but passed off, and during the evening no one would suppose that the patient had been intensely melancholy in the early morning. These cycles of depression recur and recur with pretty regular precision.’

Similar cycles are observable in the sane. A personal

¹ Hack Tuke’s *Dictionary of Psychological Medicine*, Art. ‘ Alternation of the Neuroses.’

friend of my own, who has suffered financially during the recent disastrous droughts in Australia, tells me that whenever, as not infrequently happens, he wakes at 3 or 4 A.M., his monetary troubles seem almost insuperable, but that later when the sun has risen and he has had his morning shower, his prospects put on an altogether different, that is, brighter, complexion. This is no isolated instance.

§ 802. MENSTRUATION.—I have assumed, at the onset of the menstrual flow, a tendency to hyperpyraemia; and to this blood state, and to the associated vascular and hepatic conditions, have been ascribed most of the ‘normal’ symptoms of menstruation. Amongst the normal symptoms detailed in Dr. Helen McMurchy’s paper¹ already referred to, occur the following:—Changes in individual character: disinclination for society: tendency to pessimism and mental depression: irritability of temper, loss of patience: insomnia. Bearing in mind the gradations between sanity and insanity, it will cause no surprise that amongst female lunatics the approach of the menstrual period is often the signal for exacerbations of the mental derangement; and that, as pointed out by Barnes,² ‘museums can easily be stocked with the organs of menstruating women in consequence of the fact that they so often commit suicide at this time.’

Inadequacy or suppression of the flow is still more marked in its influence. Dr. George S. Walker says: ³—‘It is a well-known fact . . . that amenorrhoea is not infrequently met with in the insane’; and Sutton and Giles⁴ point out that ‘if in such a case menstruation comes on again, the mental condition often improves.’ Macnaughton Jones says: ⁵—‘There can be no doubt that perverted or suppressed menstrual functions, at any time of the active physiological life of the ovary, but more especially from puberty to womanhood and during or approaching the menopause’—that is, at the two periods when hyperpyraemia is most probable,—‘does lead up to insane impulses, delusions and illusions.’ Tilt⁶ found that of 500 women at the menopause, sixteen became insane. ‘Short of such we have every form of hysteria, instability of purpose, mental

¹ *Lancet*, 1901, October 5.

² Quoted by Haig, *Uric Acid in Disease*, 1897, p. 260.

³ *Brooklyn Medical Journal*, June 1903.

⁴ *Diseases of Women*.

⁵ *Diseases of Women*, Macnaughton Jones, p. 625.

⁶ *Change of Life*, 1882, p. 158.

incoherence and depression bordering upon true melancholia.'¹ Barnes² says of insanity in women :—‘The epoch of severest trial is the climacteric or menopause. . . . Melancholia is the most common form of climacteric insanity. Sometimes the erotic form is marked. In some of these, there is uterine disease . . . but in other cases no lesion can be discovered.’

Speaking of puerperal mania which has passed into a state of dementia, Savage says :³—‘Such cases as a rule will be found to be suffering from amenorrhoea, or if not, the prognosis is grave in the extreme. I have always looked upon the consecutive weak-mindedness of puerperal mania as being curable while menstruation is absent, but when physical health is re-established without mental gain, the prognosis is bad.’ It may be argued of such cases that while amenorrhoea continues there remains a possibility that the insanity depends upon hyperpyraemia, but that this possibility vanishes, or becomes extremely small, when menstruation has returned.

§ 803. PREGNANCY AND LACTATION.—It has been argued that during pregnancy decarbonization proceeds at a rate higher than the average at other times. Hence we shall not perhaps be able to regard insanity developing during pregnancy as due to hyperpyraemia. But it may be significant that ‘these cases are not nearly so common as those following childbirth’⁴ (Savage). It may be said that we cannot regard post-puerperal insanity as due to hyperpyraemia, since lactation is then taking the place of utero-gestation as an added means of decarbonization. But in two cases observed by myself, the onset of mental symptoms was preceded for a few days by a marked diminution of the lacteal secretion, and I have reason to think such an event is not exceptional.

Again, ‘cases are recorded in which insanity has passed off when conception has taken place’⁵ (Savage).

The fact that insanity not infrequently results from prolonged lactation does not, *per se*, preclude hyperpyraemia as a factor in such cases. Prolonged lactation as a cause of insanity is most common in the poor: in them, it is often associated with a deficient supply of proteid. The combination

¹ *Diseases of Women*, Maenaughton Jones, p. 625.

² Hack Tuke’s *Dictionary of Psychological Medicine*, Art. ‘Climacteric Insanity,’ by R. Barnes.

³ *Insanity*, 1886, p. 375.

⁵ *Ib.* p. 365.

⁴ *Ib.* Geo. Savage, 1886, p. 364.

will lead to anaemia and to depraved nutrition on the part of the nitrogenous tissues: hence physiological decarbonization may be inadequate, and hyperpyraemia arise.

§ 804. FAT-FORMATION.—In many insane persons who are also physically weak and badly nourished, an improvement in the mental condition proceeds concurrently with an increase in weight: this is consistent with the theory that hyperpyraemia is a factor in the mental disorder in such cases. And the fact that the cases in which improved nutrition, even obesity, occurs without abatement in the mental symptoms are amongst the most hopeless of all, is, if anything, confirmatory; for in such, we should probably be justified in excluding hyperpyraemia from the etiology.

§ 805. PYREXIA.—Savage says:¹—‘ Persons suffering from insanity may be temporarily or even permanently cured by the occurrence of some acute bodily ailment.’ Of such ailments, he says:—‘ Either they are painful, such as inflammation of the skin, or they are associated with fever and increased temperature and bodily change’; but it is worthy of note that in practically all the specific instances which he gives, the physical disorder which replaces the mental affection is such as would be associated with distinct fever. He says:²—‘ We have seen acute mania pass off on two occasions after severe attacks of toothache associated with abscess forming at the base of a tooth-stump. We have seen the like result follow severe inflammation of the hand due to self-inflicted injuries, and also though counter-irritation by blisters and setons has had very little beneficial effect’—blisters cause no pyrexia, setons only very slight—‘ yet the ordinary development of a carbuncle has been followed by mental recovery or complete remission of the symptoms. The same holds good of large subcutaneous cellular abscesses. We have seen general paralysis of the insane arrested for several years by the development in one case of a large carbuncle, and in the other by the formation of several very large abscesses. Erysipelas, and, we believe, more particularly erysipelas of the head, may be followed by marked improvement in mental disorder. Fevers, inflammations of the lung, consumption and the like, may also be associated with cure or relief of mental disorder.’

¹ *Dictionary of Psychological Medicine*, Hack Tuke, Art. ‘ Alteration of the Neuroses.’

² *Ib.*

Savage gives some remarkable examples of alternation between insanity and acute rheumatism. In one case, severe rheumatic fever was treated by salicylic acid. Within forty-eight hours the whole of the joint symptoms passed off, and the patient rapidly developed acute mania, for which she was sent to an asylum. ‘Here¹ she was maniacal in an extreme degree, and showed no signs of the rheumatic attack, till quite suddenly during one night her knees again became red and tender and the mind began to clear. In twenty-four hours, the rheumatic fever was again re-established and she was sane.’ Later, there was a second remission of the rheumatism and a recurrence of the mental disorder, although no salicylic acid was given. Later still, ‘the rheumatic fever slowly passed away, after it had lasted some weeks, and the mind was restored, the patient keeping well without recurrence of the rheumatic fever.’²

Of enteric fever, Colin M. Campbell says:³—‘The somewhat vague doctrines of therapeutic substitution and counter-irritation . . . receive some not to be despised support from those records of the effects of enteric fever in the insane, where this disease, notwithstanding its usually unfavourable effect on brain and nerves, would seem to have exerted a favourable influence on the mental state, similar to that following other acute disorders of which numerous scattered cases may be found in the records of alienism.’ Of six cases of enteric fever occurring amongst inmates at Bethlem Hospital and recorded by Dr. Percy Smith,⁴ in two ‘a definite, sudden abatement of maniacal symptoms appeared concurrently with the onset of the fever, and the mania did not recur. . . . In one other case the patient had entered upon mental convalescence before the discovery of any febrile process, but the mental improvement progressed concurrently with the latter and was certainly not delayed by it. In the remaining three cases, there was no permanent benefit,’ but in two, there was temporary abatement in the violence of the mental symptoms. The author suggests⁵ that ‘perhaps at some future date, when the specific fevers have been rendered manageable, acute attacks of insanity may be cured by inoculation.’

¹ *Dictionary of Psychological Medicine*, Hack Tuke, Art. ‘Alternation of the Neuroses.’² *Ib.*

³ Hack Tuke’s *Psychological Dictionary*, Art. ‘Fever, Effect of, in Insanity.’⁴ *Ib.*⁵ *Ib.*

§ 806. The nature of the pyrexia and its cause seem immaterial. George Keith, in criticizing the practice of forced feeding in the insane, says: ¹—‘In one lady, a case of stupor, gastritis was set up by irritation from the tube, and *curiously enough*, the pyrexia was coincident with the commencement of her recovery.’ (The italics are Keith’s.) Pyrexia, so induced and so complicated, would seem peculiarly well adapted to disperse hyperpyraemia, since it would not only, as probably do all pyrexias, increase the expenditure and output of carbon, but would also preclude, to a relatively greater extent than other pyrexias, the digestion and absorption of fresh material, as pointed out by Keith. The slight septic pyrexia which is associated with the wearing of a seton seems effectual in some cases. Speaking of climacteric insanity, Barnes says ² that ‘a seton on the arm is sometimes strikingly beneficial, even conservative.’

The following case came under my own observation :—

A lady suffered from irritability, temper, and excitability, amounting almost to insanity at all times, but fully amounting to insanity at each pre-menstrual period. She developed early phthisis, with an evening temperature of 101°. Thereupon, she became quite rational and quiet in manner at all times. The phthisis being taken early in hand and treated in the modern rational way, she rapidly underwent symptomatic cure. Thereupon, she promptly relapsed into her previous mental condition.

Dr. Lewis C. Bruce ³ injected two cubic centimetres of sterilized turpentine into the subcutaneous tissue of twenty-five patients suffering from acute mania. The local result was the formation of an abscess containing blood serum and pus. In twenty-three of the patients there was induced a febrile attack within twenty-four hours after the injection. In several, the temperature rose as high as 102° F. In none, was the patient the worse physically. This author adds :—‘Some of the results . . . were so satisfactory, from a recovery point of view, that I never hesitate to induce an abscess in every case of acute mania which does not rapidly improve under ordinary treatment.’

Thyroidism is associated with increased combustion which, in some cases, is indicated by distinct pyrexia ; and H. A. Hare

¹ *Fads of an Old Physician*, 1897, p. 139.

² Hack Tuke’s *Dictionary of Psychological Medicine*, Art. ‘Climacteric Insanity.’

³ *Journal of Mental Science*, April 1903, referred to in the *Lancet*, May 2, 1903, p. 1255.

points out¹ that thyroid gland 'in the dose of from 5 to 20 grains three times a day, according to the degree to which it produces its effects . . . has proved of value in acute mania and melancholia, puerperal and climacteric insanities, and in stuporous states with primary dementia. The treatment should be persisted in for at least thirty days, according to Mabon and Babcock.'

§ 807. Many well-authenticated cases are recorded in which acute gout has developed simultaneously with the retrocession of all mental symptoms ; and there are others in which sudden mental disorder has usurped the place of an expected attack of gout. 'It is noteworthy that in some cases in which a gouty patient has become suddenly melancholic, the attack may come on quite suddenly and quite early in the morning, so that a patient who has been liable to recurrence of gout is found intensely depressed on a certain morning, and from that time remains deluded and suicidal, no change occurring till, some morning early, he has an attack of gout, when all depression of mind passes away'² (Savage). Less commonly, mental alienation and arthritic gout are concurrent, but it is significant to note that in no such case (as far as I can discover) is the arthritic affection *acute*. Henry Rayner³ describes a case in point. A man had long suffered from gout with mental depression. Somewhat suddenly, he sank into a condition of profound melancholia. 'He suffered from *subacute* attacks of gout during the whole period of his mental affection, which lasted for six years. Recovery followed *more acute* joint affection, and general improvement of bodily health.' (Italics mine.) The same author points out that the retrocession of gout is well recognized as a cause of mania and other mental disturbances : of this he gives many instances.

Savage says⁴ that insanity may be 'coexistent with and also coextensive with gout' ; but the case which he adduces in illustration shows that he uses the term gout to include the period of unrelieved hyperpyraemia which precedes the acute arthritic outbreak. This is, of course, the ordinary signification of the term. Otherwise, in the more restricted sense, the gouty

¹ *Practical Therapeutics*, 1900, p. 395.

² Hack Tuke's *Dictionary of Psychological Medicine*, Art. 'Alternation of the Neuroses,' by Geo. Savage.

³ *Ib.* Art. 'Gout, Insanity from,' Hy. Rayner.

⁴ *Insanity*, 1886, p. 433.

paroxysm in Savage's case most distinctly alternated with the insanity, which was coexistent, and possibly coextensive, with the preceding hyperpyraemia.

As frequently pointed out, hyperpyraemia, impossible during pyrexia of any intensity and duration, is peculiarly prone to arise during convalescence: hence it is not infrequent for insanity to date from this period. Fagge says: ¹—‘After fevers it is not uncommon to meet with more or less mental weakness, which does not depend much upon the severity of the fever. This is not uncommon after typhoid fever, and may range from simple loss of memory to loss of control and mania, with emotional disturbance.’

§ 808. MIGRAINE.—The close affinity between migraine and insanity was long ago noticed by Marshall Hall. He says: ²—‘How often would due attention to sick-headache and similar warning affections ward off the more formidable attacks of apoplexy or epilepsy—yes, and of mania!’ Savage says: ³—‘Complaints of headache are rare amongst the inhabitants of an asylum’; and this is in all probability because the association between headaches and insanity is one of alternation, or antagonism: ‘almost invariably with the onset of insanity the tendency to the recurrence of the headache ceases.’ ⁴ He mentions several cases of such inverse correlation. In one, ‘the onset of active melancholia with suicidal tendencies was associated with loss of periodical headaches, and his recovery was timed in relation to the recurrence of these nerve-storms.’ ⁵ In another, a lady became intensely suicidal and only regained her mental balance when her accustomed recurrent headaches returned. So constant was the antagonism between headaches and insanity, that many cases were refused their discharge from the asylum until the headaches had returned, even when the insanity seemed to be in abeyance.

§ 809. ASTHMA, HAY-ASTHMA, AND CHRONIC BRONCHITIS.—Savage says: ⁶—‘Asthma, whether occurring in gouty or other patients, may be distinctly found to alternate with insanity: as a rule the insanity with which it alternates is of a melancholic

¹ *Text-book of Medicine*, 1891, vol. i. p. 845.

² *Megrin and Sick-headache*, 1873, p. 206.

³ *Dictionary of Psychological Medicine*, art. ‘Alternation of Neuroses’

⁴ *Ib.*

⁵ *Ib.*

⁶ *Ib.*

type'; and he goes on to give numerous examples. 'A patient¹ who has been completely invalidated in consequence of spasmodic asthma suddenly loses the difficulty of breathing, and at the same time becomes insane. The insanity may be of the maniacal type, it may be associated with delusions, or it may be melancholic. The period of true insanity is variable, but almost always passes off as suddenly as it came on, leaving the patient again a prey to asthma.'

Of hay-asthma, the same author says:²—'In one case a lady of about 30, who had suffered from hay-asthma every spring so that she had specially to be provided for at that season, became insane during the winter and remained so during early spring, and it was a question of grave moment to her friends, what they should do with her if she were still insane and unable to be moved as usual to a healthy seaside place. We were able to promise that as long as she was insane they need not fear the hay-asthma, and our promise was fulfilled, but with return of sanity, the symptoms of hay-fever returned.' In such a case, in all probability the returning asthmatic paroxysms dispersed the hyperpyraemia which was an essential factor in the disordered cerebral function.

Paroxysmal asthma has been regarded as a recurrent acarbonizing process, chronic bronchitis as a manifestation of unrelieved hyperpyraemia; and it has been argued that the two conditions pass by an unbroken series of clinical and pathological gradations into each other. Conformably, it is impossible to draw any sharp line of demarcation between them as regards the efficiency of their acarbonizing action; nor can we deny that the most typical chronic bronchitis is without effect in this respect. Hence we shall be prepared to find that chronic bronchitis, as well as paroxysmal asthma, replaces, and is replaced by, various forms of insanity. Savage says:³—'A lady of about 60, who had for seven or eight years been a subject of chronic bronchitis, which rendered her life almost a burden to her for all the winter months of the year, became actively melancholic, suicidal, and deluded, and at the same time was free from her bronchitis. In one such case there had

¹ *Dictionary of Psychological Medicine*, art. 'Asthma and Insanity,' Geo. Savage.

² *Ib.*

³ Hack Tuke's *Dictionary of Psychological Medicine*, art. 'Alternation of the Neuroses.'

been two attacks of melancholia, and each of these was associated with freedom from the recurrent bronchitis.'

The following case is to the point:—

A gentleman followed an occupation which entailed considerable physical labour. His weight then averaged 10 stone, and he enjoyed good health. At the age of 47 he entered politics, a comparatively sedentary occupation. Soon he began to lose weight. An attack of pneumonia was followed after about nine months by asthma. This became irregularly recurrent and associated with continuous bronchial catarrh. At the age of 55, he became a complete invalid. His weight was under 8 stone, he had some permanent expansion of the chest, severe chronic bronchitis, associated with severe nocturnal asthmatic paroxysms. Still, he would have intervals of one or perhaps two days, during which the asthma remained in abeyance. During one of these intervals, he became unusually drowsy, and in forty-eight hours, when it was to be expected that the asthma would return, it was evident that he had altered mentally. He became suspicious, restless, occasionally noisy, and insisted that he was being detained against his will. Later, he became very delusional and inclined to violence. This condition lasted for some weeks, during which he put on weight and improved materially in physical condition. I ventured to prophesy that some morning early he would have an asthmatic attack and recover his reason. This is what occurred. Asthma began about 4 a.m., and by breakfast time he was perfectly rational.

The relations of insanity to migraine, asthma, hay-asthma, etc., might be explained on the theory of accumulation and discharge of nerve force; but this theory would hardly explain the relation of insanity to chronic bronchitis, any more than to gout, pyrexia generally, etc.

§ 810. EPILEPSY.—If we believe that both epilepsy and insanity may own a common factor in hyperpyraemia, we shall be in a position to understand clearly the various relationships of the two disorders. Savage says:¹—‘A young lady recently under our care is amiable, pleasant, and in every way agreeable till within a few days of an epileptic seizure, when she becomes troublesome, restless, inclined to quarrel; she is sleepless and at times noisy at night. This period of restless excitement lasts only a few days, and is followed by an epileptic fit, which always occurs in the night, to be followed by a short period of languor, which ushers in a return of mental calm.’ Here, we

¹ Hack Tuke's *Dictionary of Psychological Medicine*, art. ‘Epilepsy and Insanity,’ p. 453.

may suppose, increasing hyperpyraemia expresses itself in disordered cerebral function until the acarbonizing convulsion clears the blood and permits of a return to the normal mental state.

In other cases, paroxysmal insanity follows an epileptic fit. Here, while making due allowance for the directly injurious effect of a convulsion on the brain, we may suppose that the fit has been inefficient as an acarbonizing measure, and that the insanity occurs in spite, rather than in consequence, of the convulsion. This conception receives much support from the fact that, 'in those¹ cases in which the mental disorder is well marked, and especially where automatism is exhibited, the preceding fit is generally but slight' (Savage) : and Broadbent says :²—'After *petit mal*, which may consist merely of a momentary suspension of consciousness, with fixation of the features and staring eyes, there is no coma, but there may be maniacal excitement of extreme violence.' We may fairly imagine that such maniacal excitement is substitutive of the strong tonic and clonic convulsions of major epilepsy, since both conditions are adapted to promote acarbonization of the blood through increased combustion.

Further support of this view is obtained from the observation 'that in chronic insanity with epilepsy, the mere treatment of the fits is of little or no avail as far as the mental disorder is concerned, and it is noteworthy that even in some younger and less chronic cases, the treatment of the fits does no good, if not harm, to the patient.'³ (Italics mine.) Savage says :⁴—'We have met with several instances of patients who have suffered from slight attacks of epilepsy, who, having been relieved or cured of the fits of convulsions, have from that time begun to degenerate mentally, and we have elsewhere described cases in which epileptiform, if not epileptic, fits have been followed by mental improvement ; for though, as a rule, with each recurring attack of convulsions one looks for some slight increase in the nervous instability, yet, from some hitherto unexplained cause, severe convulsions may occur during some phases of insanity, which may be followed by recovery.'

¹ Hack Tuke's *Dictionary of Psychological Medicine*, art. 'Epilepsy and Insanity,' p. 453.

² *Brit. Med. Journal*, January 4, 1902.

³ Hack Tuke's *Dictionary of Psychological Medicine*, art. 'Epilepsy and Insanity,' by Geo. Savage. ⁴ *Ib.*

Gowers¹ says of epilepsy:—‘When attacks that have occurred during many years stop suddenly, whether the stoppage is spontaneous, or due to the influence of drugs, patients may become dull, forgetful, sometimes irritable, and sometimes half idiotic. The effect is often ascribed to the remedy, especially if this is bromide. . . . A fit may completely remove the state. It is common for patients to say that they feel better when they are having fits than when they are not.’

Liveing says:² ‘Insane paroxysms may alternate with, replace, or be replaced by epileptic seizures.’ Maudsley says:³ ‘Sometimes an outbreak of mania precedes or takes the place of an epileptic attack; and it may happen that a painful form of moral derangement with periodical exacerbations—a masked epilepsy—precedes for months the appearance of genuine epileptic convulsions.’ Again, the same author says:⁴ ‘In children, as in adults, a brief attack of violent mania, a genuine *mania transitoria*, may precede or follow or take the place of an epileptic fit; in the latter case being a masked epilepsy. Children of three or four years of age are sometimes seized with attacks of violent shrieking, desperate stubbornness, or furious rage, when they bite, tear, kick, and do all the destruction they can: these seizures are a sort of vicarious epilepsy, come on periodically, and may either pass in the course of a few months into regular epilepsy, or may alternate with it.’

Finally ‘it is not to be forgotten that the use of full doses of the bromides, particularly in epileptics of an advanced type, sometimes causes maniacal outbursts in place of the epileptic attacks’ (Hobart Amory Hare).⁵ (The italics in this quotation are mine.) Doubtless in such cases the organism has come to depend for acarbonization largely upon the prepotent recurring convulsions. The drug throws out of gear the pathological machinery of the conservative convulsions, with the result that more or less unrelieved hyperpyraemia ensues. And considering the inevitably damaging influence of prolonged epilepsy upon the mental faculties, it is but natural that hyperpyraemia, arising in these circumstances, should have a psychical mani-

¹ *Dis. Nerv. System*, Gowers, 1893, vol. ii. p. 749.

² *Megrin and Sick-headache*, 1873, p. 203.

³ Reynolds’s *System of Medicine*, art. ‘Insanity,’ vol. ii. p. 15.

⁴ *Gulstonian Lectures* for 1870, p. 69.

⁵ *Practical Therapeutics*, H. A. Hare, eighth ed. p. 556.

festation. Quite possibly in cases of more recent origin in which, consequently, the mind is less affected, or unaffected, hyperpyraemia arising through suppression of convulsions by bromides, might eventuate in some less distressing pathological manifestation: it might of course be averted by physiological acarbonization. On some occasions, I have seen severe sick-headaches arise under the above conditions: on others, a mere increase of fat-formation. The administration of bromides in epilepsy should, in my opinion, always be accompanied by acarbonizing treatment, and this should bear some proportion to the diminution in the number and severity of the fits.

§ 811. HAEMORRHAGE, which, we have seen, may disperse, temporarily at least, many disorders depending on hyperpyraemia, may seemingly disperse some of the psychical manifestations of hyperpyraemia. Sankey says:—‘Marshall Hall relates the case of a gentleman who endeavoured to commit suicide by dividing the veins at the bend of the elbow in his bath, and who, as the blood flowed, became changed in mind, and sent for a surgeon to bind up his wound, remarking to the surgeon, “Had Sir A—— B—— been bled, he never would have committed suicide.”’¹ Sankey himself witnessed a similar occurrence. He says: ²—‘As a student I was once called upon to bleed a gentleman who was greatly depressed in mind, and as the blood flowed, the patient gradually changed, and before his arm was bound up, he began to joke and relate seafaring anecdotes of the usual comic kind.’ And Barnes, speaking of the treatment of climacteric insanity, says that ‘where the subjects are plethoric, occasional venesection or cupping, howsoever strange bleeding may appear to those who have never witnessed the effect, . . . is sometimes strikingly beneficial, even conservative.’ Presently I shall point out, on the authority of Broadbent, that many cases of insanity, especially melancholia, are associated with, if they do not depend upon, high blood-pressure; and it seems probable that, in the above two and similar cases, the salutary effect of venesection is immediately due to reduction of blood-pressure. But even so, the factor, only one degree more remote, upon which the high blood-pressure depends, is in all probability hyperpyraemia.

¹ *Lectures on Mental Disease*, Sankey, second ed. p. 311

² *Ib.*

§ 812. GLYCOSURIA.—The alternation, long since observed by Maudsley, between diabetes and insanity in the family history, may occur also in the individual. Savage says:¹—‘In some cases of chronic diabetes, mental disorder may occur for a time, to be again replaced by diabetes, which, in its turn, may be again replaced by insanity. Thus there may be a double column, as it were, of alternations. Even in general paralysis of the insane, diabetes may occur, and for a time with the onset of acute symptoms the diabetes may disappear, to reappear when the disease has made more rapid progress.’ Elsewhere the same author says:²—‘It is uncommon to find this disease’ (diabetes) ‘well marked among insane patients’; and, ‘I know of no *direct* relationship between diabetes and insanity’³—the relationship is inverse, that is to say.

§ 813. INSANITY AND BLOOD-PRESSURE.—Broadbent says:⁴—‘An unbroken series of gradations can be traced from the irritability and depression of spirits attending functional disorder of the liver and other ailments, up to complete melancholia with delusions.’ Elsewhere we have seen that the so-called manifestations of functional disorder of the liver depend quite often upon glycogenic distension, secondary to hyperpyraemia.

W. Bezly Thorne says:⁵—‘With the aid of the sphygmometer, I have been able to verify the fact that depression, the indefinable sense of impending disaster, irritability, and insomnia, are generally associated with high blood-pressure, and have observed that the lowering of that pressure is followed by very satisfactory results.’ And Broadbent says:⁶—‘In a very large proportion of cases of melancholia coming on late in life, the evidence of persistent high tension of the pulse has been most marked.’ It has been argued that persistent high blood-pressure is a common manifestation of unrelieved hyperpyraemia.

In the cases referred to, Broadbent is of opinion that ‘persevering endeavours to diminish the peripheral resistance and at the same time to strengthen the action of the heart

¹ Hack Tuke's *Dictionary of Psychological Medicine*, art. ‘Alternation of the Neuroses,’ Geo. Savage.

² *Insanity*, 1886, p. 411.

³ *Ib.* p. 412.

⁴ *The Pulse*, 1890, p. 304.

⁵ ‘Blood-pressure in the Insane,’ Letter in *Lancet*, July 16, 1898

⁶ *The Pulse*, 1890, p. 306.

have been more successful than any other line of treatment.' The same author admits¹ that it is not easy to distinguish the symptoms which depend upon high blood-pressure from the symptoms which depend upon the blood-state responsible for the high pressure; but he thinks that the 'circulatory conditions are not unfrequently an intermediate cause,' and he is sure 'that the pulse affords a clue to treatment.' It may be added that the measures recommended for the reduction of blood-pressure in these cases are such as would be capable of dispersing hyperpyraemia. While Broadbent has found melancholia associated with high pulse tension, amenable in a certain proportion of cases to treatment which disperses this vascular condition, he has, on the other hand, observed that melancholia associated with extremely low pulse tension is as a rule incurable.² We might of course infer that in the latter case there is a smaller probability that hyperpyraemia enters into the etiology.

H. de M. Alexander says³ that in acute passive melancholia the blood-pressure is invariably high and remains so until the acute physical and mental symptoms abate. A re-elevation occurs with each relapse of the disease. The average maximum blood-pressure, measured by Hill and Barnard's sphygmometer, is 155 mm. Hg.

It has been argued that acute mania is an acarbonizing process (§ 266); and it seems probable that it is, in some cases, a manifestation of hyperpyraemia. If so, we should, perhaps, expect the blood-pressure to be high before an attack, and to fall progressively during the attack. Conformably, H. de M. Alexander says:⁴—'I have always found the symptoms, mental and physical, *antecedent* to an attack of mania to be accompanied by a rise of blood-pressure.' (Italics mine.) As regards the blood-pressure during the attack, there is a difference of opinion. 'Dr. Maurice Craig⁵ found that acute mania was associated with a low pressure, the average . . . in thirty-three cases . . . being from 105 to 110 mm. Hg.' H. de M. Alexander,⁶ on the other hand, finds it invariably above normal. Possibly these differences depend upon differences in the period of the attack at which the observations were made, for acute mania is progressive in its acarbonizing influence.

¹ *The Pulse*, 1890, p. 176.

³ *Lancet*, July 5, 1903, p. 19.

⁴ *Ib.* p. 20.

² *Ib.* p. 307.

⁵ *Ib.* p. 19.

⁶ *Ib.*

' In thirty-four cases of epileptic insanity examined, a blood-pressure of 130 mm. Hg. was the average reading obtained '¹ (Alexander).

§ 814. PLUMBISM, which, as inferred, may lead to hyperpyraemia through retarded metabolism, not infrequently leads to mental derangement. Gowers says :²—' Hysteria is often evoked by lead-poisoning in young girls, who are so often the subjects of its acute form. More frequent, however, is mental disturbance which may necessitate confinement. The most common form is melancholia with delusions, or mental derangement with hallucinations, somewhat resembling alcoholic insanity. Sometimes there are symptoms of mental failure and muscular weakness resembling those of general paralysis of the insane, but coming on more rapidly. True general paralysis of the insane, with exalted delusions, typical course, and post-mortem appearances, has occurred in the subjects of lead-poisoning, and may have been due to it (Monakow, Ullrich).'

Fagge says :³—' Lead-poisoning may produce maniacal excitement, or it may end in dementia. The same poison may produce all the symptoms met with in general paralysis and may almost certainly give origin to that disease.' We have seen that lead is a cause of high blood-pressure (§ 743) ; and it may of course be that high blood-pressure is a proximate factor of insanity, where lead-poisoning is so associated. This is almost certainly true of epilepsy associated with plumbism.

§ 815. MORBID ANATOMY.—So far as I can see, nothing that is known as to the morbid anatomy of insanity is inconsistent with the view that, in many cases, hyperpyraemia constitutes an essential factor. We have seen that persistent high blood-pressure may be a manifestation of unrelieved hyperpyraemia, and may depend upon a state of more or less continuous vaso-constriction of the systemic arterioles. George Johnson has argued that continuous vaso-constriction is prone to be followed by hypertrophy of the muscular tunic of the arterioles and by hypertrophy of the heart. And later I shall ascribe to long-standing hyperpyraemia—or to conditions secondary thereto—some cases of vascular, cardiac, and renal degeneration (Chapter XXIV). Now it has long been known that all these hypertrophic and degenerative conditions are to be found with

¹ *Lancet*, July 5, 1903, p. 20. ² *Diseases of the Nervous System*, 1893, vol. ii. p. 954.
³ *Text-book of Medicine*, 1891, vol. i. p. 845.

more than average frequency in post-mortem examinations of cases of chronic insanity.

Sankey says: ¹—‘ In chronic insanity, the condition of the small arteries is remarkable, and Dr. Major’s description of what he met with in chronic brain wasting coincides exactly with my own experience. These vessels have a “ coarseness of appearance.” They show clearly both an increased calibre and thickness of walls. When the vessels are separated by washing out from the brain tissue, they lie in the field of the microscope like rounded thongs instead of flaccid tubes, the circular fibres are coarser and evidently hypertrophied, and there is, as Dr. Major expresses it, an enormous multiplication of the minute nuclei scattered over the whole of the walls.’ It seems probable that in such cases the average condition of the cerebral arteries during life was one of slight continuous vaso-dilation, either active and, to some extent, compensatory of the more general systemic vaso-constriction, or passive and due to increased general blood-pressure. It seems likely, in chronic insanity, that the brain tends to be hyperaemic, rather than anaemic ; and the characters of the cerebral arteries, referred to by Sankey, would be explained by an early stage of arterio-sclerosis, compensatory of loss of muscular tone through prolonged dilation or distension (compare Thoma’s views on the mechanism of arterio-sclerosis, § 877, 878).

‘ Disease of the heart is common among the insane, although Griesinger affirms that the newest and most reliable statistics show only an average frequency.’ ² Sir C. Hood ³ found that ‘ heart disease occurred six times more frequently among the insane in York Retreat than among the general population.’ Burman concluded ⁴ in 1873 ‘ that there is a remarkable relation between heart disease and insanity, in that, co-existing with the gradual but steady annual increase of insanity, there has been a similar and more than *pari passu* increase of heart disease. An examination into the state of the heart in the insane, as found after death and during life, shows that heart disease in its various forms is exceedingly common amongst them, and presumably much more frequently met with in asylums than out of them.’ And quite recently, Dr. Adolf

¹ *Lectures on Mental Disease*, 1884, p. 236.

² Bucknill, quoted by Sankey, 1884, p. 240, *Lectures on Mental Disease*.

³ *Lectures on Mental Disease*, Sankey, 1884, p. 240.

⁴ *Ib.* p. 241.

Meyer,¹ Director of the State Pathological Institute of New York, has stated that observations on the heart and aorta of the insane show that arterio-sclerosis is exceedingly frequent.

Concerning renal degeneration, Sankey says:² ‘On first entering upon my medical duties among the insane, I was much struck with the frequency with which kidney disease occurred in my autopsies. . . . I found adhesion of the capsule to occur in nearly one half of my own autopsies, and besides this, there existed in a large number abundant evidences of disease, as atrophy of the cortex, fatty degeneration, waxy disease, and general atrophy.’ And Savage says:³ ‘I have found a number of cases of insanity in which there has been marked degeneration of the kidneys.’

§ 816. HUMORAL VIEWS OF OTHER WRITERS.—Ford Robertson⁴ makes out a strong case in favour of the view that insanity, as well as functional nervous disease in general, depends, with few exceptions, primarily upon ‘disorders of nerve-cell nutrition.’ He suggests that ‘there are at least two respects in which the chemical substances brought by the blood-vessels to the cortical neurons, may be unsuitable for their healthy nutrition.’

In the first place, ‘there may be a deficiency of certain constituents which are needed for the normal metabolism.’ As an example, he cites the occasional mental disorder which results from profuse haemorrhagic anaemia. He thinks, however, that ‘there are strong grounds for believing that . . . deficiency of nutritive materials for the nervous elements is not of very much practical importance’; and he seeks justification for this view in the fact that ‘Lugaro and Chiozzi, in their experiments upon the effects of inanition upon the nerve-cells, found that these elements were unchanged until shortly before death.’ It must be freely admitted that the nervous are the very last of the tissues to suffer from withdrawal of food. But we can hardly infer from this that deficiency of nutritive materials for the nervous elements is not of great practical importance: rather must we infer that there is no such practical deficiency even during starvation, at least until the latest stages. The only deficiency of nutriment which

¹ *New York Medical Record*, January 31, 1903, quoted in *Lancet*, February 28, 1903, pp. 604, 605.

² *Lectures on Mental Disease*, Sankey, 1884, p. 241.

³ *Insanity*, G. H. Savage, 1886, p. 407.

⁴ *Brit. Med. Journal*, June 21, 1901.

could directly affect the nervous tissues would be a deficiency in the blood ; and it is well recognized that, during starvation, the blood tends to keep up its composition by withdrawing nutriment from all the tissues of the body to a greater extent than from the nervous tissues. Thus in starvation, the nervous system lives at the expense of the rest of the organism. We may conclude, therefore, that deficiency of nutriment for the nervous tissues *would be* of great importance, but that such deficiency can rarely be present. Haemorrhage, of course, is just one of those emergencies in which such deficiency might arise.

'The other possible respect in which the chemical substances brought by the blood-vessels to the cortical nerve cells may be unsuitable for their healthy nutrition' is stated by Ford Robertson¹ to be 'the presence of substances which are taken up by the cell and then disorder its metabolism. Such a substance is a toxin for that cell.' The implied definition of a toxin is extremely wide, and, if it might be extended to cover substances which in moderate amount are physiological, but in excess pathological, then the greater part of Dr. Robertson's paper might be read as an argument in favour of the theory of hyperpyraemia. At any rate, the paper is a strong argument in favour of a humoral basis for insanity and functional nervous disorders in general.

Sankey, speaking of ordinary insanity,² considers that 'the symptoms and morbid anatomy show that the disease consists in a morbid state of the blood, or of the processes concerned in nutrition.' 'During the earlier period of the disease, the symptoms are due to an alteration of the blood in its quality and in its amount: next there is some congestion and interstitial deposit of serum and of protein compounds, then atrophy of the brain-substance and hypertrophy of the vessels. The alteration of the vessels is the result of the usual law: at first they resist the influx of impure blood by contracting, then the heart takes on increased action to overcome the resistance of the contracted vessels: the contracted vessels, thus called upon to antagonize the heart, gradually become hypertrophied.'³ This view of the general vascular changes may be correct; but as regards the changes of the cerebral vessels, we have already

¹ *Brit. Med. Journal*, June 21, 1901.

² *Lectures on Mental Disease*, Sankey, 1884, p. 243.

³ *Ib.* p. 242.

preferred the hypothesis that they depend in the main upon prolonged vaso-dilation (active or passive) and upon secondary sclerosis.

Sankey reviews George Johnson's investigations on the vascular changes associated with chronic renal degeneration, and infers therefrom that 'hypertrophy of arterioles shows impurity of the circulating fluid.'¹ But he guards against the conclusion that 'insanity is a disease of the kidneys.'² While he admits that, in disease of the kidney leading to cardiac hypertrophy, the kidney disease may be the primary affection and the impurity of the blood a consequence thereof, he states that in insanity it is rather the opposite course that occurs. 'The changed condition of the blood is due to an error of assimilation, and when the kidney becomes involved, it is probably, or quite as likely, a secondary result induced by the state of the blood.'³ In short, he considers the insanity and renal degeneration as co-results of the disordered blood-state. This is the view taken in this work; but there seems no reason for excluding from this pathological view the cases where renal degeneration, cardiac and vascular hypertrophy, are unassociated with insanity.

CAUSES OF INSANITY, OTHER THAN HYPERPYRAEMIA, AND OTHER THAN HUMORAL

§ 817. It is not, of course, maintained that hyperpyraemia, wide and comprehensive term though it be, includes all the humoral factors of insanity. Savage says:⁴ 'The initial delirium of a fever, such as scarlet fever, may start the morbid process, and the patient pass from delirium into mania.' In such cases, hyperpyraemia might probably be excluded; and it is quite likely that many morbid blood-states are capable of giving rise to the cerebral malnutrition upon which some cases of insanity presumably depend. But apart from all humoral conditions, it is clear that ample room is left for all the already accredited factors of insanity. None will question the influence of neurotic predisposition, whether hereditary or acquired, of anxiety, worry, excitement—religious or other, of mental and moral shock, of fright and alcoholism. Some of these may act

¹ *Lectures on Mental Disease*, Sankey, 1884, p. 245. ² *Ib.* p. 246. ³ *Ib.*

⁴ *Insanity*, 1886, p. 74.

indirectly by leading to morbid conditions of the blood : others doubtless determine a mental expression of the underlying blood disorder. Again, since the pathological acarbonizing processes so often result in convalescence from insanity, we must include in many cases of mental aberration a long series of negative factors—an absence of factors which would have initiated pathological acarbonization, and thus have averted the unrelieved hyperpyraemia which manifested itself mentally.

Finally, it is clear that the factors other than humoral are of higher import in the complete etiology of insanity than the humoral factors. This becomes at once evident when we consider that the humoral factor, hyperpyraemia, in some cases of mania and melancholia, for example, is identical with the humoral factor which, in persons more psychologically stable, would have led to such comparatively unimportant disorders as recurrent sick-headaches or bilious attacks. In effect, the arguments adduced in the present chapter seem to me to leave the pathology of insanity generally very much where it was, with the exception that they superadd in some cases a hyperpyraemic factor.

SUMMARY

§ 818. In this chapter, I have argued that some cases of neurasthenia, of disturbed vision, and of insanity own a common essential factor in hyperpyraemia.

CHAPTER XXII

§§ 819–840

Unrelieved hyperpyraemia (*cont.*)—Cutaneous manifestations—Evidence of hyperpyraemia: gouty diathesis: variations in combustion: daily fluctuations in the carbon contents of the blood: menstrual fluctuations in the carbon contents of the blood: pregnancy and lactation: fat-formation: pyrexia: acute gout: glycosuria: the paroxysmal neuroses: food—Factors in skin diseases other than humoral—Summary.

§ 819. The view that many forms of skin disease have hyperpyraemia for a common factor is supported by observations and arguments essentially similar to those which have been adduced in support of the dependence of vascular, respiratory, nervous, and psychical affections upon hyperpyraemia. It can be shown that many cutaneous affections are dispersable by physiological and pathological processes and by therapeutic measures, which can have hardly any effect in common except the power of acarbonizing the blood. These cutaneous affections it will be convenient to consider as manifestations of unrelieved hyperpyraemia, although it is probable that some of them are, to some extent, acarbonizing processes, through associated pyrexia,¹ anorexia, etc.

EVIDENCE OF HYPERPYRAEMIA

§ 820. GOUTY DIATHESIS.—Many skin diseases have long been ascribed to the ‘gouty diathesis’: most prominent amongst these are eczema, pityriasis rubra, psoriasis, pruritus and prurigo, urticaria, including the giant form, herpes, and acne (Ewart).² But I shall argue later that the manifestations of the so-called gouty diathesis depend upon hyperpyraemia (§ 858 *et seq.*); and it will be shown that the cutaneous disorders referred to, and many others, are but little more intimately associated with gout than they are with

¹ *Diseases of the Skin*, R. Crocker, p. 80.

² *Gout and Goutiness*, Ewart, 1896, p. 239 *et seq.*

most pathological acarbonizing processes depending on hyperpyraemia.

Reference may here be made to the old and firmly rooted prejudice against the cure of certain skin diseases. It was thought either that the inflammation of the surface acted as a counter-irritant, obviating a similar condition internally, or that the cutaneous discharge was an outlet for some poisonous humour which, if retained, would injure the system. Speaking of eczema, herpes, and prurigo, P. Hood said,¹ these affections ‘are for the most part, when occurring in the gouty, distinctly forms of gout ; and will be found either to require treatment addressed to the disorder, or else, if they yield to such remedies as arsenic combined with local applications, to leave, in many cases, far more mischief behind.’ This writer thought that any cure of the skin disease, ‘which was an outlet for discharges,’ is highly dangerous, unless the greatest attention ‘afterwards be paid to the state of the health and to the functions of the great emunctories.’

Superficially, there was much to encourage these ideas. Many gouty, asthmatic, and neurotic persons were known to be peculiarly liable to skin diseases ; and it was observed that the skin was mostly affected in the intervals of the paroxysmal affections. Further, the incidence of the latter was often roughly contemporaneous with the abatement or retrocession of the former : hence the paroxysmal outbreaks were ascribed to the skin disorder being ‘driven in.’ Such a view is almost inevitable, so long as we fail to recognize the existence of the large class of pathological acarbonizing processes depending on hyperpyraemia—so long as we continue to regard the paroxysmal neuroses as primary neuroses having no humoral origin and influence. Now, however, it is more reasonable to explain the alternation between neurosal and cutaneous affections by ascribing to the former the dispersion of the humoral condition upon which depend the latter : this, at any rate in most instances.

But in the case of lesions like ulcers, lupoid, rodent, varicose, and other, which are sometimes classed under cutaneous affections, it is highly probable—to my mind certain—that the above sequence of cause and effect may be reversed. Such lesions are, in many cases, undoubtedly capable of pro-

¹ Quoted by J. M. Fothergill, *Gout in its Protean Aspects*, 1883, pp. 219, 220.

moting efficient acarbonization, both through the direct loss of material involved in profuse discharge and through a slight degree of septic pyrexia. It is easy to find cases in which the healing of chronic ulcers has been followed by the recommencement of hyperpyraemic affections, which have long remained in abeyance (§ 328); and we have seen recurrent articular gout inhibited by the chronic ulceration induced by old gouty deposits (§ 593).

§ 821. VARIATIONS IN COMBUSTION.—The influence of external thermal conditions upon skin disorders is well marked. Those who have practised in the tropics know of many cases of eczema and other dermatoses which have convalesced almost immediately on removal to a cooler climate; and we may reasonably ascribe a part of this happy result to increased combustion or katabolic decarbonization, without ignoring other factors, such as diminished perspiration, etc.

Muscular exercise greatly increases combustion, and is a valuable therapeutic adjunct in many skin diseases. Speaking of the influence of sweets and rich food in causing suppuration of the follicles in acne, J. F. Payne says:¹—‘Some young men can produce this result with experimental precision, especially if living in town and taking insufficient exercise, although with abundant open-air exercise they can indulge in such articles of diet with impunity.’

Thyroid extract is known to promote combustion and increase the output of carbonic acid: it is, therefore, a decarbonizing agent. Conformably, Byron Bramwell has shown that, in many cases, the systematic administration of thyroid extract has a salutary influence upon psoriasis, and, if I remember correctly, upon several other cutaneous affections. T. P. Beddoes² records the following highly significant account by a patient of his own case:—‘February 1, 1904—Had eczema and asthma very bad, Michaelmas term, 1896. Better at once on going home at Christmas. Bad again Lent term, 1897; about mid-term started thyroid treatment. During vacation and Easter term, from March to end of June—i.e. four months—continued thyroid, and had no return of eczema and asthma, but got steadily better, and discontinued thyroid at end of term. From end of June 1897 to June 1898 used

¹ Clifford Allbutt's *System of Medicine*, vol. viii. p. 755.

² *Treatment*, June 1904, p. 252.

thyroid occasionally whenever eczema appeared, generally for periods of about fourteen days. Went up to Cambridge, October 1898, and from then to May 1901 extremely fit. . . . The duration of treatment was four months ; then intermittently for twelve months, whenever eczema appeared, for about a fortnight at a time. Used no other medicine that I can remember.' It may be mentioned that Lent is a favourite period for the accentuation of many hyperpyraemic disorders, probably on account of the increased carbonaceous intake demanded by the omission of meat.

Oxygen inhalations have proved successful in skin affections, in all probability through accelerating combustion. Demarquay says :¹—' We owe to oxygen five cures of rebellious cutaneous diseases which were diagnosed by the author under the name of leprosy.' Dr. Samuel S. Wallian treated eleven cases of chronic eczema by this means : three were cured or fully relieved : two were sensibly relieved ; and six were little or not at all relieved.²

§ 822. DAILY FLUCTUATIONS IN THE CARBON CONTENTS OF THE BLOOD.—Most skin diseases are insidious in their onset and of prolonged duration : hence we can hardly expect to find many observations as to the *time of day* when they commence. But in some acute and evanescent affections, such observations can be, and have been, made. Of the wheals of angio-neurotic oedema, Herman B. Baruch says :³—' They often come on in the early morning, when vitality is at its lowest ebb.' In my experience, the same is true of the ordinary variety of urticaria. In a patient of mine, a hospital nurse who suffered from urticaria alternating with recurrent migraine, the eruption was present on awaking in the morning. This, however, was when she was on day duty. When on night duty and sleeping through the day, the eruption was present on awaking in the late afternoon.

Dr. C. Von Rad describes a remarkable case of alternating neuroses in all probability hyperpyraemic. The patient, a man of 47, had been the subject of rheumatism. Later, he had come to suffer from paroxysms of epilepsy, gastralgia, vertigo, tachycardia, bradycardia, and angio-neurotic oedema. The

¹ *Oxygen and other Gases in Medicine and Surgery*, Demarquay and Wallian, pub. F. A. Davis, p. 52.

² *Ib.* p. 240.

³ *Med. Record*, August 19, 1902, p. 257.

incidence of the last clearly showed the influence of the retardation of combustion during the night. ‘Towards 6 A.M. every morning, the skin of the head swelled, slowly attained a maximum size, and three or four hours later began to subside. The oedema involved the face, scalp, and upper part of the neck, which was reddened and extremely painful and tender. . . . Simultaneously, there was mental dulness, general malaise, and severe cardiac oppression. Usually the voice was hoarse and devoid of resonance. . . . The hoarseness was probably due to oedema of the larynx, and the gastric symptoms and dysphagia to oedema of the gastric and oesophageal mucosa.’¹

§ 823. MENSTRUAL FLUCTUATIONS IN THE CARBON CONTENTS OF THE BLOOD.—Radcliffe Crocker says:²—‘Many eruptions, such as urticaria, acne vulgaris or rosacea, and eczema, are aggravated a few days before the menstrual flow occurs.’ Tilt says:—‘Simpson had under his care two cases of amenorrhoea, in both of which the face was thickly studded with acne rosacea. In one case, the eruption had repeatedly diminished considerably whenever local uterine treatment restored the menstrual flow.’³ Rousseau, speaking of the symptoms which commonly precede menstruation, says:⁴—‘In a very considerable number of cases, one or several small pustules of acne appear on the lips and chin.’ Dr. Helen McMurchy, from the study of a hundred replies to a circular requesting information as to the symptoms of menstruation, says:⁵—‘A large number’ (41 per cent.) ‘report eruptions on the face, lips, and chest, especially on the face. Probably those on the chest and shoulders frequently escape observation.’ Jamieson has made similar observations.⁶ Dr. Hawkes tells me of a patient of his who is attacked by eczema of the umbilicus two days before each menstrual period: the eruption lasts four or five days and then fades. My own observations tend to the conclusion that almost all skin eruptions become exaggerated about the onset of the menstrual period: a pre-menstrual increase of acne is, so far as I can see, *invariable*.

‘Among⁷ the rarer phenomena which have been observed

¹ Quoted by *Med. Rev.* from *Münch. Med. Woch.*, February 25, p. 318.

² *Diseases of the Skin*, p. 22. ³ Tilt, *On Uterine Therapeutics*, 1878, p. 289.

⁴ *Clinical Medicine*, New Syd. Soc., vol. v. p. 215.

⁵ *Lancet*, October 5, 1901.

⁶ *Skin Diseases*, third edition, p. 389.

⁷ *Lancet*, June 14, 1902, pp. 1709, 1710.

to recur in conjunction with menstruation, are symptoms such as herpes labialis, an erysipelas-like eruption of the face, erythema circinatum on the backs of the hands, fugitive erythema elsewhere, and purpura. At the meeting of the Société Médicale des Hôpitaux of Paris, on May 23, M. Henri Dufour described the following interesting case. A healthy but very nervous married woman, aged 42 years, had at every menstrual period for five years an eruption of round nummular erythematous spots which recurred *in situ*. The first spot appeared on the right side of the neck, was exactly circular, and attained the size of a two-franc piece. It always recurred *in situ*, and was accompanied by five or six satellites which appeared later. At the last three periods, a similar spot had appeared at the bend of the right elbow, and at the end of the last period, a spot had appeared for the first time on the back of the left hand. After some days, the spots gradually lost colour. In the intervals between the periods, slight pigmentation indicated the sites of eruption, and in some places this disappeared entirely. *The spots appeared the day before menstruation.* . . . At the onset, they were accompanied by malaise, a febrile state, and headache. . . . M. Dufour thinks the recurrence of the eruption *in situ* is determined by the existence of a previous lesion on which the neuro-vascular phenomena of menstruation act electively. A little further development of the morbid process would cause haemorrhage from the skin, and the occurrences of similar spots on the mucous membrane would probably result in haemorrhage. Hence the case furnishes a key to the explanation of vicarious menstruation. . . . In the discussion which followed, M. Barié referred to a case of "yellow catamenial chromidrosis" which he had described. *Two days before menstruation*, one hand became painful: then it became covered with large dark-brown spots which were especially marked near the middle of the dorsal surface and on the median part of the palmar surface of the first two fingers. This phenomenon was so regular that the patient could foretell the appearance of menstruation forty-eight hours before. The chromidrosis lasted twelve or twenty-four hours and then disappeared. The right and left hands were alternately affected with perfect regularity' (Lancet). (The italics in the foregoing quotation are mine.)

§ 824. All the cutaneous manifestations preceding or accom-

panying the onset of menstruation are liable to be exaggerated if something intervenes to check or prevent the flow: I have several times seen acne made worse by a change of climate (which should have been beneficial) because the first result was amenorrhoea.

The following extraordinary case will serve to show that, even in early infancy, menstruation may be an essential safeguard against hyperpyraemia and its manifestations, cutaneous and other. Dr. J. W. Irion¹ says he confined Mrs. N—— on October 10, 1895, of a girl infant, weighing nine pounds, and normal in physical condition. ‘On the morning of the 17th, I was called to see the baby. I found the infant in good condition, sleeping well and taking its nourishment as it should. I was told by the mother that, upon her usual examination of the child that morning, she noted a bloody discharge from the vagina. Upon examination, I found the condition as the mother had described it. The child seemed in no way disturbed. The flow lasted for four days. In December the flow did not return, and the child suffered with all the nervous phenomena that usually accompany the missing of a period in an adult, and she broke out from the top of her head to the soles of her feet with an eczema that persisted for some time, but gradually subsided. Her mother attributed the non-return of the flow in December to a rather cold bath the day before the flow was expected. Since December, the flow has returned with perfect regularity, and the child is in good health, skin fair and clear, eyes bright and intelligent. The breasts and mons Veneris in the child are considerably developed, and during the flow the breasts enlarge and are somewhat sensitive to the touch.’

Delayed menstruation at puberty is frequently associated with severe cutaneous disorders, especially acne, which, in some cases, disappears when the flow becomes regular. Similarly, at the climacteric, cutaneous disorders are very common. Tilt says:²—‘Of 500 women, forty-one had some form of cutaneous disease, but I have certainly found eczema much more frequent than this represents, and the same remark applies to prurigo. . . . Herpetic affections, long forgotten, may then reappear. . . . Balmanno Squire, operating on 5,000

¹ *New York Med. Journal*, August 15, 1896, p. 227.

² *Change of Life*, 1882, p. 284.

cases of cutaneous diseases, found skin disease to be much more common at puberty and at the change. . . . Hunt found the change of life to be often followed by acne rosacea, lichen in the face and elsewhere, prurigo, and especially prurigo pudendi. . . . A patient of mine had never had the slightest rash before the menopause, whereas nettle-rash appeared four times in the year which followed cessation. . . . Alibert observed some cutaneous eruptions to appear twice only in life, *once before first menstruation, and again at its cessation*, and like Gardanne, I have twice known both periods to be preceded by an abundant eruption of boils.' (Italics mine.)

§ 825. PREGNANCY AND LACTATION.—We have seen that the exaggerated decarbonization associated with these physiological processes is capable of maintaining in abeyance many of the manifestations of hyperpyraemia. The cutaneous manifestations form no exception. Though it is true that many eruptions appear during, and only during, pregnancy, yet others, such as 'eczema and psoriasis, may clear up during pregnancy'¹ (Crocker); and the same is true of lactation.

On the other hand, the 'termination of lactation' is mentioned by Crocker as a common period for the commencement of eczema.

§ 826. FAT-FORMATION.—A well-developed fat-forming capacity has been regarded as an efficient physiological means of decarbonization; and I do not think it will be disputed that those who are inclined to *embonpoint* have, on the average, fresher complexions and smoother skins, less prone to pimples and other disorders, than those who are of meagre build. Of course there are many exceptions, but we have all seen a great improvement in the condition of the skin occur concurrently with increasing weight.

§ 827. PYREXIA.—Jamieson says:² 'We sometimes see extensive disorders of the skin fade rapidly away on the occurrence of some of the specific fevers, the exanthemata, and acute inflammations of internal organs. The inflammation here cannot be regarded as the outcome of the disappearance of the efflorescence, but the cutaneous disease vanished in consequence of the occurrence of the inflammation or other disease. We know this because certain diseases—notably psoriasis and

¹ *Diseases of the Skin*, Crocker, p. 23.

² *Diseases of the Skin*, third edition, p. 51.

scabies—reappear when the bodily health has been re-established.' The antagonism between disorders of the skin and pyrexia seems to me far more complete than might be inferred from the above sentence. In my experience, during typhoid at least, pre-existing acne almost invariably subsides, or becomes much less prominent. On the other hand, it is especially prone to recur during the period of convalescence: sometimes it then makes its first appearance. It is, too, during the later stages of the fever, when exaggerated combustion is ceasing, or during convalescence, that cutaneous and subcutaneous disorders, such as boils, are common; and I believe that similar rules apply to many other skin affections.

Dr. W. J. Fearnley, resident medical officer in charge of the Brisbane Hospital fever wards, has collected for me some cases illustrating the alternation between pyrexia and skin affections. Two of these may be referred to here.

J. O'S——, aged 40. Had been under treatment for papular eczema for six months. He contracted typhoid fever, and during the attack his eczema disappeared in spite of frequent bathing which had previously aggravated the trouble. During convalescence, it reappeared, however, and is now as bad as ever. F. J——, aged 16. Admitted to hospital with early typhoid fever and with striking crop of acne vulgaris on face. Three weeks later the spots had practically disappeared.

Dr. Hawkes tells me of a curious case.

A patient had eczema of the scrotum and purulent gonorrhœa. These two affections did not concur: on the contrary, it was when the latter had been controlled by injections, etc., that the former broke out. This sequence recurred on several occasions.

The following is a personal experience:—

The writer, when a youth, suffered from severe and disfiguring acne. He was liable also to recurrent attacks of febricula, lasting two or three days. But he consoled himself to some extent for the latter, because each pyrexial attack was accompanied, and, for a short time, succeeded, by a most noticeable subsidence of the facial eruption.

Similar alternations, if searched for, will be found among the commonest occurrences in medicine: even a slight feverish

cold has a beneficial influence upon acne: and so, as in the following case, has the wearing of a seton:—

A girl of 18 suffered from migraine once a week. She lost a whole day's work thereby, and was consequently unable to retain any situation. She suffered also from very severe acne and menorrhagia. Dr. Hawkes treated her by the insertion of a seton in the left infra-mammary region. As a result, the migraine paroxysms retrogressed to one a month on the day before menstruation; there was a marked diminution in the amount of menstrual loss; and the acne disappeared absolutely.

§ 828. The sudden disappearance of acne may be the first indication of commencing tubercular consumption.

A lady of 22, who had suffered severely since puberty from suppurating acne, rather suddenly convalesced in this respect, to her great delight. Simultaneously, she contracted a slight cough with only very occasional expectoration. Examination showed that her evening temperature was over 100°, and that the sputa contained bacilli. She rapidly convalesced under open-air treatment.

In the above case, the altered appearance of the skin led directly to the very early diagnosis: it was, indeed, the sudden unexplained subsidence of the acne which first roused suspicion, prompted search for the existence of some pathological acarbonizing process, and led to the discovery of pulmonary tuberculosis. Consequently, there can be little doubt that a knowledge on the part of the medical attendant of the influence of slight pyrexia on acne was, in this case, one of the most important factors of the apparently complete cure of the pulmonary disease which rapidly ensued. Of course, what applies to the influence of pyrexia upon acne applies also to the influence of all inconspicuous acarbonizing processes, for example glycosuria, upon pre-existing conspicuous acarbonizing processes, physiological as well as pathological. Failures to diagnose a disease arise, in the majority of cases, through failure to suspect the disease; and I know of no circumstance more suspicious of the onset of some new pathological acarbonizing process, than the sudden unexplained subsidence, or modification, of some previous acarbonizing process or manifestation of hyperpyraemia. The previous inhibited process may be physiological, for example fat-formation, or pathological, for example any of the paroxysmal neuroses, gout, recurrent

catarrh, dermatoses, etc. A monograph packed with illustrative cases might, with great advantage to practical medicine, and especially to the branch of diagnosis, be written on this subject.

§ 829. It may be held that pyrexia disperses acne by diminishing *function*—the functional activity of the sebaceous glands—in the same way as pyrexia diminishes the functional activity of the salivary and peptic glands. It may be so; but no such explanation could hold of the dispersion of acne which frequently follows reduction of the carbonaceous intake, increased physical exercise, and exalted fat-formation: in all these cases and in many more, the essential factor in the aesthetic result must be diminution of the *supply* of raw material, which is available for sebum-formation by the manufacturing nitrogenous tissues of the sebaceous follicles.

The general characteristics of the skin in pyrexia are highly suggestive of an abnormal absence of sebaceous material. Watson says of hectic fever—but his remarks, I think, apply more or less to all prolonged fevers which are unaccompanied by specific eruptions:—‘The skin, when not perspiring, is harsh and scurfy: little branny scales may be rubbed from the legs, merely by the friction produced in drawing off the stockings’: ¹ that is to say, the skin in fever may be dry or moist, it is never greasy.

§ 830. ACUTE GOUT.—This recurrent pyrexia possesses the power in a marked degree to disperse many of the cutaneous manifestations of hyperpyraemia. Garrod says: ²—‘In many cases which have come under my notice, it was observed that when the succession of gouty attacks became interrupted for any length of time, there was a development of eczema to an extensive degree.’ Of acne, the same author says: ³—‘A gentleman, 38 years of age, had gout in the great left toe in August 1861, which was preceded by acne; from that time until December 1863, the toe was frequently threatened, the acne and the articular affection appearing to alternate. At a later date, severe gout came on in the left ankle and great toe, and the skin affection completely vanished. I again saw the patient in 1866; acne had been present in a severe degree for about six weeks, but had disappeared since the redevelopment of gout in the left foot.’

¹ *Principles and Practice of Medicine*, 1857, vol. i. p. 181.

² *Gout and Rheumatic Gout*, 1876, p. 454.

³ *Ib.* p. 455.

Duckworth says :¹—‘ Alternation of pruritus with articular gout has been noted. . . . Psoriasis is sometimes met with in gouty persons, and may alternate with articular attacks. . . . Cases occur in which alternations of articular gout, psoriasis, and bronchitis are manifest. . . . True gout figures in the etiology of dermatitis exfoliativa perhaps in one-fifth of the cases, and it may alternate with attacks of it. . . . Acute eczema may replace an articular attack.’

Ewart says :²—‘ Eczema might almost be regarded as the cutaneous form of gout, so intimate is its relation with the disease . . . it may at times in the individual take the place of the arthritic seizure, or precede for an interval of years the onset of the arthritic period. Indeed in some instances, the arthritic period may never be reached, and eczema then becomes in the clinical history an isolated manifestation of gout. More commonly, however, its later visitations may even be delayed . . . till advancing age has considerably reduced the liability to the arthritic ills. . . . Urticaria is another instance of the reaction of the skin to the influences which promote the arthritic form of gout. The frequency of nettle-rash in many who are not gouty should be remembered by the side of those instances where the same mechanism, viz. some error of diet, may provoke either the arthritic, or the cutaneous, gouty response. . . . Angio-neurotic oedema is probably related to urticaria. This rare affection may occur in gout. Graves described a case under the name of fugitive gouty inflammation.’

§ 831. GLYCOSURIA.—‘ The skin of diabetics is generally dry and harsh, with not uncommonly a tendency to desquamation of the epidermis ’³ (Saundby); but these characters are observed mostly in the severer forms of the disease: ‘ many diabetics are fat with a smooth skin and pink faces ’⁴ (Fagge). In either variety, the condition of the skin is opposed to what obtains in acne, etc.

Overt inflammatory disorders of the skin appear to be uncommon in *severe* diabetes. ‘ Acne, pustules, boils, and carbuncles occur not infrequently in elderly diabetics ’⁵ (Saundby).

¹ *Treatise on Gout*, 1890, p. 317 *et seq.*

² *Gout and Goutiness*, 1896, p. 239 *et seq.*

³ *Renal and Urinary Diseases*, Saundby, 1896, p. 292.

⁴ *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 573.

⁵ *Renal and Urinary Diseases*, Saundby, 1896, p. 292.

It is in elderly diabetics, of course, that glycosuria is most likely to be inadequate for acarbonization; and in such we may perhaps assume that the skin affections arise in spite of the glycosuria. In support of this, Williamson may be quoted. He says :¹—‘Boils . . . often occur at an early stage. . . . In the advanced cases . . . admitted into the Manchester Royal Infirmary . . . they are very rare. Boils generally occur in stout patients.’ Speaking of anthrax and furuncular inflammation, Duckworth says :²—‘It is not within my experience that grave and intractable cases of diabetes often present this symptom. Marchal called these boils “furoncles uriques” and regarded them as “gout of the cellular tissue,” believing that they were vicarious of more obvious gouty inflammation in the joints.’ It would appear that the boils and glycosuria own a common cause, and that as the latter becomes potent and disperses the common cause, the former tend to disappear. The only skin affections which seem at all common in diabetics are pruritic affections and eczema, limited to the neighbourhood of the external organs of generation; and these palpably own a local cause in the irritation of saccharine urine.

It must be admitted, however, that boils, carbuncles, ulcers, gangrenous sores, and many infectious diseases, especially influenza, tend to *cause* a temporary glycosuria, which, as a rule, lasts only so long as the infectious process and disappears when the fever comes to an end (Saundby).³

I can find no reference in the works at my disposal to the influence of glycosuria to disperse pre-existing dermatoses. Yet I believe such occurrences must be common. I have certainly known extensive acne, and, I think, several other cutaneous affections, clear up suddenly upon the supervention of diabetes in young subjects. The subjoined may be an illustrative case. Mr. R. E. H. Woodforde says :⁴—‘A man, aged 23 years, came to me on September 16, suffering from acne vulgaris of the face. A few of the spots were pustular. He was given boric acid ointment and, a week later, the rash had much improved; he then complained of “feeling hot inside,” but was not thirsty. . . . On September 30, his mother mentioned that he was thirsty.’ The case turned out to be one of extremely rapid diabetes: it ended fatally on October 3.

¹ *Diabetes Mellitus*, 1898, p. 225.

² *Med. Annual*, 1901, p. 263.

³ *Treatise on Gout*, 1890, p. 192.

⁴ *Lancet*, November 2, 1901.

It seems improbable that the rapid improvement in the acne was due to the boric acid ointment.

§ 832. THE PAROXYSMAL NEUROSES.—It is curious to note that neither Liveing nor Salter seems to have observed the very marked association existing between migraine and asthma, respectively, and numerous forms of skin disease. The omission seems to demonstrate clearly how the observations of the most clear-sighted clinicians may be unconsciously restricted by the dominance of a preformed theory. As Darwin¹ has pointed out, new observations and thoughts which are opposed to one's general results are 'far more apt to escape from the memory than more favourable ones.' Both Liveing and Salter started with the preconception that the special affections of which they treated were, in most cases at any rate, primarily nervous: hence the majority of the associated disorders which they indeliberately selected for prominent notice were such as seemed susceptible of a purely nervous pathology. It is true that, at the present day, some seek to ascribe many dermatoses to disordered innervation primarily, but half a century ago the neurological bias had hardly proceeded so far.

But be all that as it may, no unprejudiced observer can now doubt that the paroxysmal neuroses are often intimately associated with various forms of skin disease. West says:²—'Asthma has succeeded to extensive eczema; and so marked is the connexion between the two conditions, that I have never known eczema to be very extensive and very long continued, without a marked liability to asthma being associated with it.'

Duckworth says:³—'Metastasis of gouty eczema has been suspected with good reason in cases where asthma . . . has supervened on its disappearance, constituting, in the language of the French school, a veritable exanthem.' The frequent association between urticaria and asthma led Sir Andrew Clark⁴ to regard asthma as an urticaria of the bronchial mucous membrane; and the difference between this conception of the mechanism of asthma and the one adopted in this work is of terms only. I know of more than one case of asthma in which the paroxysm was invariably preceded by an urticarial

¹ *Life and Letters*, vol. i. p. 87.

² *Dis. Infancy and Childhood*, seventh edition, p. 359.

³ *Treatise on Gout*, 1890, p. 319.

⁴ Goodhart, in Clifford Allbutt's *System of Medicine*, vol. v. p. 291.

rash, which disappeared as the dyspnoea commenced : in one in which the wheals were very large, the patches last visible were inside the buccal cavity. Malcolm Morris calls attention to the occurrence of an acute rapidly spreading form of psoriasis, associated with headache, asthma, and other neuroses ;¹ and to a form of eczema which appears at puberty, and alternates with neuroses, especially asthma.² He adds :— ‘Asthma is so often associated with eczema that whenever the latter affection comes before me, I am in the habit of asking if the patient is subject to asthma.³ . . . It is probable that both the eczema and the asthma are the response by the skin and respiratory mucous membrane respectively to some central or peripheral irritation to which both alike are exposed.’⁴

Migraine is, in my experience, associated with skin affections to a less extent than is asthma, to a much less extent than is gout : the dominance of gout in this respect is probably due to the severity and duration of the more or less unrelieved hyperpyraemia which antecedes the articular paroxysm (§ 607). But I know of several cases in which migraine and urticaria (both the ordinary and the giant variety) distinctly alternated on more than one occasion in the pathological life-history of the patient.

The relationship of angio-neurotic oedema to the paroxysmal neuroses, and especially to migraine, is further illustrated by the concomitance of gastro-intestinal symptoms, such as vomiting and purging towards the end of the disorder, and by polyuria at its termination.⁵

Epilepsy of all the paroxysmal neuroses seems the one which tends most to become prepotent and thus to avert the minor degrees of hyperpyraemia : hence, probably, the rarity of its association with skin diseases. But Bouchard says :⁶— ‘J’ai observé une jeune fille chez laquelle des crises épileptiformes alternaient avec l’acné. Après chaque attaque, l’acné disparaissait totalement, pour reparaître ensuite graduellement et arriver enfin à défigurer la malade jusqu’au jour où éclatait enfin un nouvel accès.’ And I have myself seen an acne, regarded as bromide, clear up in a remarkable way after several severe attacks of *haut mal*, although the bromide was being

¹ *Diseases of the Skin*, 1903, p. 294.

² *Ib.* p. 250.

³ *Ib.* p. 259.

⁴ *Ib.* p. 268.

⁵ *Medical Record*, August 19, 1902, p. 257.

⁶ *Les Maladies par Ralentissement de la Nutrition*, 1890, p. 78.

continued. Of course I am not suggesting that the bromide causes acne only through checking the decarbonizing convulsions: yet sometimes it would seem to act, in great part, in this way.

§ 833. FOOD.—Many clinical observations attest the connexion of improper feeding with eczema, but the connexion is very differently explained by different writers. Willson and others assume ‘assimilative debility,’ Tilbury Fox ‘retained excreta, which in the blood act as irritants to the tissues.’ Radcliffe Crocker thinks ‘they are all instances of irritation of the alimentary canal, which reflexly irritates the nerve centres, and produces dilatation of the capillaries of the region affected.’¹ For ourselves, we have little option: we must regard the eczema in most cases as due to hyperpyraemia, and the associated dyspeptic conditions as co-expressions of the same blood-state or, perhaps, as direct results of (protests against) an over-carbonaceous food supply. Such a view will at least bring into line a larger number of clinical observations than any other. Eczema, even infantile eczema, though frequently associated with dyspepsia, occurs not rarely in a severe form when dyspepsia is completely absent. The frequency of eczema at dentition, though commonly ascribed to reflex action, is probably due, in the main, to weaning and to the substitution of a highly carbonaceous food supply for the less carbonaceous and more nitrogenous diet of maternal milk. ‘Cheadle considers that infantile eczema is often greatly benefited by the substitution of raw meat juice and cream for milk and farinaceous substances;’² and I have seen several cases in which the mere elimination of sugar from the diet (as in the substitution of unsweetened, for sweetened, Nestlé’s milk) has been rapidly succeeded by the disappearance of an infantile eczema of some duration.

Acne is markedly dependent on food. J. F. Payne says:³ ‘I am persuaded from observation and personal experience, that certain articles of food have a direct influence in causing the suppuration of acne. Many persons who are subject to comedones find that inflammation of the follicles is produced with certainty by malt liquors, sweets, and rich

¹ *Diseases of the Skin*, R. Crocker, p. 107.

² *Food in Health and Disease*, B. Yeo, 1897, p. 511.

³ Clifford Allbutt’s *System of Medicine*, vol. viii. p. 755.

food generally.' And W. E. Thompson¹ states that acne is caused by 'eating buckwheat cakes or oatmeal, or by greasy food—doughnuts, sausages, cheese, fried meats, ill-cooked and rich pastry, excess of sweets, nuts, and other indigestible substances.'

A lady patient of mine suffers from a series of hyperpyraemic affections (biliary attacks, chronic catarrh of the upper respiratory passages), amongst them very severe acne. She has a strong digestion and an absolute passion for sweets. A diet, from which are excluded sugar and starch, except in small amount, never fails to remove all her troubles, including the acne (Case LXI).

§ 834. A simple experiment will demonstrate the dependence of comedones upon carbonaceous food. Let a few of the sebaceous follicles be emptied by pressure and a note be made of the time required for the reaccumulation of the contents. Let the experimenter then go for a week or two upon a diet of nearly pure proteid. He will find that, in these circumstances, there is but slight tendency to reaccumulation, that the skin is noticeably less greasy, that the cerumen of the ear is reproduced less rapidly and that seborrhoea of the scalp, which so frequently complicates acne, tends to disappear.

Acne rosacea is usually ascribed to dyspepsia, yet it may coexist in a high grade with a powerful digestion; and I have little doubt that the post-prandial flush is directly due to the increase in the carbon contents of the blood which follows a meal. One of my patients can demonstrate this at will. Before coming under dietetic treatment for obesity, the flushing of the nose and adjoining parts followed every meal, except breakfast, but especially lunch. Immediately when fats and carbohydrates were largely cut off, the flushing ceased; but he can reinvoke it now simply by returning to his original food-habits.

Substances which undergo rapid absorption induce the flush most rapidly: sugar, even in the form of the highly saccharine fruits, such as pineapple, starts it immediately the meal is over: these symptoms subside in about two hours. The dietetic treatment for obesity is, in my experience, by far the best treatment for acne rosacea: after a week or so, a

¹ *Food in Health and Disease*, B. Yeo, 1897, p. 511.

notable improvement appears : hypertrophy is, of course, permanent, but such swelling as is due to recurrent engorgement quickly abates. Though I do not know that they have been connected with the absorption of food, these post-prandial flushes have been often noticed. Duckworth¹ refers to a case recorded by Graves in an elderly gouty lady. ‘The attacks came on daily at three o’clock, the nose becoming hot, bright red, and later purple, the redness spreading to the cheeks, accompanied with uneasiness but not with pain. This always passed off about the same hour in the evening. Minor attacks of this disorder . . . are termed *aestus volaticus*.’ Such fugitive post-prandial flushes are not, however, limited to the ‘flush-area’ of the face. They may attack any part of the body which is damaged or in a condition of irritation. I have seen them attack a patch of ringworm on the cheek : the skin of the wrist covering a Colles fracture : the whole foot and lower part of the leg in a case of Ogston’s operation for flat foot ; and they are often especially annoying over joints damaged by chronic rheumatoid arthritis. All of them are prone to occur rapidly after alcohol, which is regarded as a common cause of acne rosacea ; but, as is well known, acne rosacea is not infrequent in lifelong abstainers.

§ 835. Malcolm Morris,² in opening a discussion on the treatment of psoriasis, refers to some severe cases associated with rheumatoid arthritis. He says that in such he has seen results from the use of an exclusively meat diet, washed down by copious draughts of hot water, which results ‘can only be called marvellous.’ Of this method, he says :—‘It was brought to my notice by a case in which all other treatment had failed, and the patient, a lady, seemed a hopeless cripple with the added burden of a very troublesome and apparently incurable psoriasis. Under other directions, she went through a course of the treatment referred to, and she came back to me after some months, in order, I suppose, that I might testify to the success of her experiment. She was a different woman, with her skin as clear as that of a child, and able not only to walk about, but to ride on horseback. I was so struck by this real cure, that I have recommended the method in several similar cases, and in many of them it has been equally successful.

¹ *A Treatise on Gout*, 1890, p. 321.

² *Brit. Med. Journal*, October 25, 1902, p. 1331.

Now I am perfectly well aware that the treatment bears upon it the stamp of unorthodoxy. For my own part, rational medicine has a natural right of property in everything that can cure disease or relieve suffering, regardless of its source. I do not wish to be understood as endorsing the extravagant claims that have been put forward on behalf of the simple method of diet which has been mentioned, as if it were a certain panacea for every ailment to which the human body is subject. My statements as to the meat and hot-water treatment must be taken as strictly limited to cases of psoriasis connected with rheumatoid arthritis.'

Such a pronouncement, coming from so eminent a dermatologist, is of great value. Nevertheless, it must, I think, be regarded as, if anything, over-cautious. The treatment of skin affections by a lean meat diet is at least fifty years old, probably older. Professor J. Bauer says: ¹—‘With regard to the enforcement of a mainly animal diet, we may remark that such a course was recommended by Passavant in the treatment of skin diseases, and practically tested by him in the case of psoriasis: a total deprivation of fats and fat meats, such as the Banting cure prescribes, he did not consider necessary to his system, although indulgence in wine, beer, or spirits, he held to be harmful. It would be useless in the present state of our knowledge to seek an explanation of the way in which an almost exclusively animal diet can effect the healing of psoriasis.’

Although I have not, except on rare occasions, resorted to it, I have not the least doubt that the Salisbury method of treatment is capable of relieving, rapidly and effectually, not only many cases of psoriasis unassociated with rheumatoid arthritis, but also many cases of skin disease having no morphological resemblance to psoriasis, and, as pointed out in many places, numerous other affections having no connexion with the cutaneous organ. A *sine qua non* for success would be the existence of hyperpyraemia as an essential factor in causation.

§ 836. Pruritus, especially, I think, pruritus ani, is, in some cases, markedly relieved or dispersed by the enforcement of a diet scale from which fats and carbohydrates (especially

¹ Ziemssen's *Handbook of Therapeutics*, vol. i. pp. 319, 320.

the latter) are largely excluded. The following is an illustrative case:—

A medical man of 40 had in the past suffered from asthma. Later, he contracted haemorrhoids. When these began to bleed, his asthma ceased to recur. The haemorrhoids were then excised by Whitehead's method. Almost immediately after leaving the private hospital, his asthma recommenced. He then discovered a district in which he remained free from asthma and took up his abode there. Upon the consequent cessation of asthma, he commenced to suffer from pruritus ani, which speedily became so severe as to lead to insomnia. The enforcement of the dietetic treatment just referred to resulted in the rapid disappearance of his distressing affection. Four months later, he informed me that he continued to remain free from pruritus and all other hyperpyraemic manifestations: this, in spite of the fact that he had resumed the use of beer at lunch and dinner, a beverage to which he had been accustomed for most of his life. He however continued to avoid sugar in all other forms and also to restrict his general carbohydrate intake.

Cases illustrating the influence of diet on skin diseases will be found in the Appendix (Cases LXXIV to LXXXII, and others).

FACTORS IN SKIN DISEASES, OTHER THAN HUMORAL

§ 837. Fagge says:—‘Humoral pathology, which pervaded medicine from classical times until almost the present day, afforded a ready explanation’ of cutaneous eruptions. ‘When the doctrine of the four humours was given up they were thought to be due to disorders of the blood: then, when better knowledge of the chemistry and morphology of the blood began to stand in the way of so easy an explanation, they were ascribed to “diatheses” or tendencies, of which the eruption was at once the evidence and the effect.’¹

It was natural that the abandonment of the old humoral doctrines should have led pathologists to fall back upon aberrations in the quality of the blood in order to explain the origin of skin affections. The doctrine of diatheses seems a natural attempt to classify the conspicuous differences in personal and hereditary proclivity to morbid action. But it is difficult to understand how the experimental work, hitherto done on the

¹ *Text-book of Medicine*, 1891, vol. ii. pp. 754, 755.

chemistry and morphology of the blood, can justify an attitude of almost total neglect of humoral views in the pathology of these diseases.

At any rate, humoral views are still largely held by the general public, and I think it is possible to detect a distinct tendency on the part of the medical profession to revert to them under the guise of 'toxaemia.'

§ 838. In the present chapter, it has been argued that the blood-state hyperpyraemia is *at least one humoral factor* in many cutaneous affections; but that gives us no right to ignore the numerous other well-known factors.¹ These we may classify provisionally into (1) extrinsic factors, or factors due to the environment, which may be thermal, mechanical, chemical or microbic; and (2) intrinsic or personal factors, including both special capacities and special vulnerabilities of the cutaneous organ, both of which may be hereditary, congenital, or acquired.

If we believe in the necessity for some such combination of factors, we shall understand how many skin disorders may be successfully treated either by local or by constitutional measures alone. 'Gouty' eczemas may sometimes be cured by shielding the part from continued external irritation, or by germicidal applications: in both cases, the extrinsic factor is presumably removed; but naturally, recurrence in these circumstances is common. On the other hand, certain skin disorders complicated with, and doubtless excited by, microbic infection or other source of external irritation, are often benefited, or cured, by constitutional measures which acar-bonize the blood, such as physical exercise, cool weather, dietetic treatment, pyrexia, etc.: here, the humoral factor is struck out. From such observations we may conclude that the cure of a skin disease by local measures does not disprove, as has sometimes been held, the existence of a constitutional factor; neither does cure by constitutional means disprove the existence of a local factor. In both cases, the results prove only that the factor removed is essential to the disorder in the case in question.

¹ 'In discussing the pathology of papulo-vesicular eczema, Radcliffe Crocker opines that probably the safest line is not to ask, Is eczema parasitic? is it a blood dyscrasia? is it a neurosis? but to acknowledge that all these are factors, and to endeavour to estimate in what proportion each plays its part in any particular case.'—'Lettsomian Lectures,' H. Radcliffe Crocker, *Brit. Med. Journal*, February 21, 1903, p. 416.

The assumption of a personal factor is inevitable, otherwise everyone suffering from hyperpyraemia and exposed to the extrinsic factors would become affected with dermatosis; and this is certainly not the case. Most of these personal factors are probably correctly regarded as 'special vulnerabilities,' dependent on some structural peculiarity of the skin: such a condition may be hereditary or acquired, and may render the cutaneous organ more responsive than the average to pyraemic or other humoral conditions, to extrinsic irritation, to infection, or to all these.

§ 839. The following case shows very clearly indeed the co-operation of factors. In it a special vulnerability of a definite tract of skin, rendering it peculiarly responsive to pyraemic conditions, was unquestionably acquired through an accidental circumstance.

A lady, aged 24, who had never suffered from any cutaneous eruption, bruised her forearm rather severely. She foolishly rubbed the part immediately with some strong embrocation. The result was an outbreak of acute inflammatory eczema. A week or so of local treatment subdued the inflammation and healing was soon after complete; but the affected area remained discoloured. However, on the two succeeding menstrual periods, one day before the flow appeared, the eczema returned and occupied the same site exactly as before. A slight modification of diet, with an increase of physical exercise, dispersed the tendency to recurrence.

But we cannot regard all pathological tendencies of the skin as conditions of increased vulnerability: some imply excessive functional activity. In sebum formation, as in fat-formation, etc., there are two fundamental factors, *function and supply*; and in all cases, we might seek to influence the amount of material formed, by influencing the one or the other of these. In this chapter, we have mainly dealt with supply but function may be more than equally important. For example, the prevalence of acne at puberty, though largely dependent upon the carbon contents of the blood—upon supply, that is to say—and in every case susceptible of considerable improvement by treatment which reduces the carbonaceous income and increases the carbonaceous expenditure, is not fully explained by conditions of supply. Increased functional activity of the sebaceous follicles, inseparable from the commencing growth of hair, is without doubt an important

factor; and this exaggerated functional activity may be regarded as determining in such cases a condition of pathological prepotency.

SUMMARY

§ 840. In this chapter, evidence is adduced which goes to show that many skin diseases, whatever their morphology, own a common factor in hyperpyraemia, or a tendency thereto. At the same time, it is pointed out that the hyperpyraemic factor is but one amongst numerous and diverse factors.

CHAPTER XXIII

§§ 841–867

Unrelieved hyperpyraemia (*cont.*) : articular and other manifestations—Gout; acute asthenic gout, or subacute articular gout : chronic articular gout—Rheumatoid arthritis : food, exercise, and external temperature : fat-formation : menstrual life : haemorrhage, lactation, and pyrexia : pathological acarbonization : unrelieved hyperpyraemia : proximate factor of the joint changes : treatment —Some atypical joint cases—The gouty or uric-acid diathesis, lithaemia, arthritism, etc. : symptomatology : diurnal fluctuation of combustion : pyrexia : oxygen : food—classification of the manifestations of unrelieved hyperpyraemia —Summary.

GOUT

§ 841. The frequent tendency, observable in the recurrent acarbonizing processes which depend upon hyperpyraemia, to become as time passes inefficient and to degenerate into the manifestations of unrelieved hyperpyraemia, is conspicuous in gout. Acute gout is, as already argued, an efficient acarbonizing process : hence it is self-curative. The pre-existing hyperpyraemia and uricaemia which have led to the acute arthritis, are dispersed by the pyrexia associated with the arthritis : hence the arthritis ceases naturally ; and there succeeds, at any rate to the early attacks, a more or less prolonged period of good health characterized by a complete absence of all hyperpyraemic manifestations. Such attacks are termed by Garrod ‘acute sthenic gout’ :¹ they occur in robust and otherwise healthy subjects ; and inflammatory and febrile reactions are decided.

Chronic gout, on the other hand, is not associated with frank pyrexia : hence its self-curative element is absent. The articular affection is progressive and terminates in permanent articular disorganization ; nor are the attacks followed by any marked relief from the symptoms of hyperpyraemia : these, indeed, tend to pass into the ‘gouty cachexia’ and end in various structural degenerations, vascular, cardiac, and renal.

¹ *Gout and Rheumatic Gout*, Garrod, 1876, p. 16.

But interposed between the extremes of acute sthenic gout and chronic gout are a number of intermediate gradations, to one of which special reference is made by Garrod.

§ 842. ACUTE ASTHENIC GOUT OR SUBACUTE ARTICULAR GOUT.—After speaking of the symptoms of acute sthenic gout, Garrod says :¹—‘ But now and then, especially in women, an acute fit may be wanting in many of these symptoms : there may, indeed, be pain and tenderness in the toe, and some amount of swelling, but accompanied with *little heat or redness, and all febrile disturbance may be absent.*’ (Italics mine.) Of this ‘acute asthenic gout,’ Garrod says :²—‘ It must not for a moment be supposed that the asthenic form is less injurious in its results than genuine sthenic gout : far otherwise, for it is more likely to lead to permanent mischief.’

We can understand that an attack of gout, which, for constitutional or local reasons, is unattended by much inflammatory reaction, will be unattended by much pyrexia : that the hyperpyraemia will be only partially relieved : that the uricaemia will tend to persist ; and that the articular and other uratic deposits will not undergo complete absorption. Hence such attacks must be regarded as more or less unsuccessful attempts at pyrexial acarbonization : they are less likely to be followed by a period of good health and more likely to be followed by articular disorganization.

§ 843. CHRONIC ARTICULAR GOUT.—Similar reasoning applies with, of course, greater force to chronic articular gout and to chalk stones. Of chronic gout, Garrod says :³—‘ The joints are usually swollen from effusions into the bursae, and more or less stiffened : there may be neither redness nor increased heat, and comparatively little pain : with an absence of febrile excitement, except perhaps a little at night, when an increase of pain usually ensues.’

It might be fair to assume that, in the absence of pyrexia, there is an absence of any increase of combustion. But such an assumption is unnecessary, for the fact has been demonstrated by experiment. I. Walker Hall, after pointing out that Magnus Levy showed an increased oxygen intake amounting to 5-10 per cent. during acute gout, states that, ‘in chronic gout,

¹ *Gout and Rheumatic Gout*, Garrod, 1876, p. 16.

² *Ib.*

³ *Ib.* p. 47.

Klemperer, Levy, and others have found only slight variations from the normal.¹

Manifestly, then, in chronic gout, the absence of pyrexia explains directly the persistence of the hyperpyraemia, indirectly the persistence of the uricaemia and the uratic deposits. And we may perhaps explain the absence of pyrexia by assuming that a joint which has long endured recurrent irritation has lost much of its original irritability and, therefore, much of its power to respond by inflammatory reaction.

The persistence of the hyperpyraemia may be inferred from the persistence of the symptoms of hyperpyraemia—from the fact that no material improvement of general health follows the slight arthritic exacerbations in chronic gout. The persistence of the uricaemia is guaranteed experimentally by Garrod, who says:²—‘In very chronic gout, the blood, even in the intervals between the exacerbations, was always discovered to be rich in uric acid.’ And the persistence of the uratic deposits may be observed at the bedside and in the post-mortem room.

Garrod says:³—‘Chronic gout seldom continues in one locality for any length of time without giving rise to serious and permanent changes of structure, consisting either in the production of partial or complete ankylosis of the joint, or the formation of the so-called chalk stones, either around the articulation, or in other parts of the body.’ That the absence of inflammatory reaction, and consequently of pyrexia, is the cause of the persistence of the deposits, is further assured by the fact that Moxon and Fagge ‘found the articular cartilages of the great toe encrusted with the salt in many cases in which no mention of gout had been made during life’;⁴ and also by ‘the fact that some of the most bulky deposits occur in parts which have never been the seat of acute paroxysms, or only of slight inflammatory attacks’⁵ (Duckworth).

§ 844. We may conclude that chronic gout is simply gout from which the self-curative feature—pyrexia—is absent: we may regard it as a worn-out pyrexial acarbonizing process, which depends primarily upon hyperpyraemia and more proximately upon the secondary uricaemia. This conception is only a speci-

¹ ‘Metabolism in Gout,’ I. Walker Hall, *Practitioner*, July 1903, p. 63.

² *Gout and Rheumatic Gout*, Garrod, 1876, p. 114.

³ *Ib.* p. 48.

⁴ *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 674.

⁵ *Treatise on Gout*, Duckworth, 1890, p. 50.

fication of Sydenham's conception :—‘ When¹ gout has gone on for many years, the fits grow easier, and the patient is worn out by weakness rather than by pain. The worst pain he now suffers is not a tithe of what he suffered when in full health. Nevertheless, the severity of the earlier disease was made good by the length of the intermissions and the full recovery during the interval. The pain was the sharp remedy of Nature, and the worse the pain, the shorter the fit. The shorter the fit, the longer and more complete the intermission.’ If we agree that the intensity of the pyrexia is directly as the severity of the pain—and this is certainly the general rule—then the two views become identical.

From medical literature there may be quoted innumerable examples to show that recurrent pyrexial, and therefore efficiently acarbonizing, articular gout, tends in the course of time to degenerate into continuous subpyrexial, or apyrexial, articular gout, which, being inefficient as an acarbonizing process, must be regarded as a manifestation of unrelieved hyperpyraemia and secondary unrelieved uricaemia. In the following case, described by Troussseau, the graduation of the efficient into the inefficient process was seemingly accelerated by the habitual use of drugs which tended to abort, or moderate, the articular inflammation :—‘ A man,² 40 years old, of vigorous constitution, though the child of gouty parents, had, from the age of 25, been subject to attacks of frankly regular acute gout. Being a friend of pleasure, and incapable of submitting to any restraint which prevented him from giving himself up to it, he had recourse to the pills of Lartigue and the syrup of Boubée, whenever the paroxysms set in. The remedies never failed to produce the effect which the patient expected from them. As soon as he felt that he was going to have a paroxysm, he employed his anti-gout medicines ; and as his attacks came on in the evening when he was going to bed, his feet were sufficiently free next morning from the gouty condition to allow him to put on soft stockings and go into society. Careless of my advice, laughing at my gloomy predictions, he continued to take his mischievous drugs. The attacks of gout, at first considerably separated from one another and limited to the great toes, soon began to recur at

¹ *Works of Sydenham*, Syd. Soc., 1850, vol. ii. p. 128.

² *Clinical Medicine*, New Syd. Soc., vol. iv. pp. 384, 385.

shorter intervals: the hands and knees were seized in their turn. The joints became surrounded with tophus, which was at first absorbed, leaving the joints quite free: afterwards, the tophaceous concretions became larger and more permanent, and over some of them the skin became ulcerated: the ulcers cicatrized, and then formed again. The attacks lost their acuteness, and yielded less promptly to the medicines which had at first so marvellously triumphed over them. To the acute succeeded a subacute state; and at the end of some years, a chronic, soft, atonic gout had taken the place of the frank gout. The time came when the patient was obliged to keep his room for several months, and even to rest in his armchair. The pains with which he was tormented were much less localized, but as he could not, and would not, endure them, he had recourse to opium, the doses of which he gradually augmented. During the latter years of his miserable existence, this unfortunate man became quite powerless . . . he died in a state of coma.'

Fothergill,¹ like Rousseau, condemns the use of medicines which moderate the gouty inflammation. Of the best known drug of this class, he says:—‘ My own view is that colchicum has an unquestionable power of allaying gouty inflammation; but that the game is not worth the candle: the relief being furnished by arresting the inflammatory process which clears the system.’ (Italics mine.)

§ 845. But there are many exceptions to the general rule that long-recurrent articular gout tends to become progressively less and less salutary in its influence; and in all such exceptions, it will be found that the paroxysms maintain their original frankly pyrexial character. Gairdner says: ²—‘ The cases . . . in which the constitution struggles well with the disease are very numerous. . . . Such persons generally have sharp and feverish attacks, attended with considerable temporary weakness. It is, indeed, not uncommon to see them pass through a long and self-indulgent life, with regular annual or bi-annual attacks of gout, which seem to have no other effect than that of restoring the individual to the enjoyment of better health; and even to observe the disease at the close of life, when all the vital and natural powers have felt the influence of time

¹ *Gout in its Protean Aspects*, 1883, p. 203.

² Quoted by J. M. Fothergill, *Gout in its Protean Aspects*, 1883, p. 152.

and progress of decay, also abate in violence and actually cease to trouble.' He refers to a case in which a gentleman suffered from gout for over sixty years, lost the affection at the age of 90, and died at 100.

RHEUMATOID ARTHRITIS

§ 846. After long consideration, I have decided to include in this chapter this obscure arthritic affection, not because I am finally persuaded that it owns an essential factor in hyperpyraemia, but for the purpose of emphasizing the clinical fact, that a dietetic and hygienic management, deducible from this hypothesis, is capable of results incomparably superior, in my experience, to those of any other treatment.

It will, I think, now be admitted that hyperpyraemia is a factor in malnutrition, and rheumatoid arthritis may be regarded as a special variety of malnutrition; and many considerations seem to connect hyperpyraemia and rheumatoid arthritis as cause and effect. At the same time, it is possible that the connexion between the hyperpyraemia and the arthritis is less direct. It may be that the arthritis depends upon some of the factors, or upon some of the results, of hyperpyraemia: in the former case, the hyperpyraemia would be incidental merely, though, as I shall presently argue, aggravative.

It goes without saying that even if hyperpyraemia is an essential factor, there must be numerous other factors—factors other than humoral—in rheumatoid arthritis. The tendency to the affection seems to be to some extent hereditary; and it may be that what is transmitted from one generation to another is some structural peculiarity or vulnerability of the joint tissues, rendering them especially prone to low inflammatory or degenerative processes, and peculiarly responsive to pyraemic conditions.

In rheumatoid arthritis, as in so many other obscure affections, recent views lean towards a humoral explanation. Bannatyne argues¹ that if, as many believe, abnormal trophic influences are the proximate factors of the arthritic changes, such might reasonably be sought in an alteration in the quality of the blood; and conformably with his discovery of micro-organisms in the effused fluid of rheumatoid joints, he is

¹ *Rheumatoid Arthritis*, 1898, pp. 16, 17.

inclined to regard this alteration as toxic in nature. But the majority of joints in rheumatoid disease contain no distinct effusion, and I cannot find that micro-organisms have ever been demonstrated in such. Until this is demonstrated, it is open for us to entertain the view that the 'dry joints' are free from infection, and that the microbes are secondary or incidental—responsible, possibly, for the synovial effusion, but unessential for the primary articular changes: microbic infection is peculiarly prone to attack damaged structures, and, in many cases, joint effusion is a late feature. But even if it is proved hereafter that microbic infection is essential in rheumatoid arthritis, that will by no means preclude a hyperpyraemic predisposition.

The evidence in favour of a hyperpyraemic origin may be thus summarized:—(1) The manifestations of rheumatoid arthritis frequently commence, and when already present, become accentuated, under such conditions and at such times as are apt to be associated with hyperpyraemia: (2) improvement usually, symptomatic cure occasionally, occurs under some conditions which promote acarbonization: (3) the association of rheumatoid arthritis with efficient pathological acarbonizing processes is, for the most part, one of alternation: (4) the association of rheumatoid arthritis with the manifestations of unrelieved hyperpyraemia is, for the most part, one of concurrence. The evidence will now be considered in detail.

§ 847. FOOD, EXERCISE, AND EXTERNAL TEMPERATURE.—Deficiency of proteid has been argued to be an important factor in some cases of hyperpyraemia (§ 202); and, *though there are many cases where this does not obtain*, deficiency of proteid is an extremely frequent antecedent of rheumatoid arthritis. An invariable result of deficient proteid is debility of the muscular system: this leads to deficiency of physical exercise, another very common factor in hyperpyraemia and a common antecedent in rheumatoid arthritis.

Leaving out of consideration the extremely poor, it is in tropical and sub-tropical regions that a deficiency of proteid is the most prevalent food fault. Here the external high temperature adds yet another factor in the pathology of hyperpyraemia; and there can be little doubt that rheumatoid arthritis is extremely common in many, though not in all, warm climates. In India, the disease is infrequent, but there, according to

Surgeon-Lieutenant-Colonel Alexander Crombie,¹ it does badly when it arises.

The injurious influence of external heat upon rheumatoid arthritis is shown in many ways. Hyde states² that the practice of frequent and prolonged hot bathing is often disastrous, resulting in general weakness amounting even to prostration, rapid loss of flesh, and increase of the joint affection ; and we have already seen that such measures may actually induce an attack of gout, presumably by precipitating hyperpyrexia through retarded combustion (§ 585). Of rheumatoid arthritis, Garrod, writing in 1876, says :³—‘ The Turkish bath is frequently recommended in this disease, not only by physicians, but also by the friends of patients, and is often looked upon as having an undoubted curative power. My experience of its use may be thus summed up :—1. During the time the patient is taking the bath, and for a short time afterwards, a feeling of relief from pain is experienced and the injured joints become more movable. 2. It is very seldom that permanent benefit is obtained from its use in rheumatoid arthritis. 3. It very often does much mischief from inducing debility. Although I have, on several occasions, cautioned patients not to use the Turkish bath, that advice has not infrequently been disregarded, and I have seen the same patients at a later period suffering more severely from the disease, owing to the treatment they had undergone. 4. I have also seen the excessive use of the Turkish bath distinctly cause rheumatoid arthritis to appear in the extreme joints of all the fingers, and this in a person who had previously enjoyed entire immunity from the disease.’ (Italics mine.)

Hyde says :⁴—‘ Lowness of temperature, if the air be pure and dry, is often advantageous’ ; and at the Diamantina Hospital for Chronic Diseases in Brisbane, which contains a large proportion of cases of rheumatoid disease, the close association between an increase of joint-pain and a spell of extra hot weather is a matter of common observation amongst the staff. It is not of course claimed that such increased pain is due solely to an increased tendency to hyperpyrexia in hot weather ; and there are exceptions to the fact.

§ 848. The influence of deficient proteid upon the tendency

¹ *Lancet*, December 14, 1901, p. 1671.

² *Rheumatoid Arthritis*, 1896, p. 52.

³ *Gout and Rheumatic Gout*, 1876, p. 537.

⁴ *Rheumatoid Arthritis* 1896, p. 70.

to rheumatoid arthritis may be inferred from many observations. England, as compared with Scotland and Ireland, is proverbially a meat-eating country; and, contrary to what obtains in gout the incidence of rheumatoid arthritis is least in England. Women are notoriously less fond of animal food than men; and Bannatyne finds¹ that, out of 293 cases, 41 only occurred in men: this again is opposed to what occurs in gout.

In one of my cases (Case LXIX), the connexion between a deficiency of proteid and the rheumatoid outbreak was quite conspicuous. The patient was a girl of 18, and, for six months before she was attacked, had been living with her father, who was a prospector in an isolated mountainous district in North Queensland. Fresh meat was unobtainable, and for the whole of the time she lived almost solely upon bread, butter, jam, and tea. Garrod refers² to a case with similar antecedents, curiously enough from the same part of the world: in his, however, prolonged lactation was a superadded factor. ‘A lady, 42 years of age, when living in Australia in the bush, was confined, and being unable to procure a good supply of cow’s milk, was induced to nurse her child for a period of twenty months: at the same time, she had herself but a very deficient supply of meat, and in consequence was reduced to a very weak state.’ She then developed severe general, but subacute, rheumatoid arthritis. ‘The causes of debility being after a short time removed, the patient rapidly gained flesh and strength, and the tendency to joint disease passed off, but not without having inflicted irremovable injury.’ Much the same occurred in my case; but, probably because the patient was younger and the affection more recent and less severe, she is now symptomatically well.

§ 849. Garrod says:³—‘Prolonged mental anxiety . . . powerfully predisposes to the disease, especially if, as is often the case, it is combined with night watching. I have known many instances where rheumatoid arthritis has followed in daughters the nursing of parents during a long illness.’ So have I: in one instance, I ventured to foretell the outbreak, and the prediction was unfortunately verified. The parent was suffering from a severe form of the disease; and her daughter, who nursed her night and day devotedly, was anaemic and debilitated.

¹ *Rheumatoid Arthritis*, 1898, p. 43.

² *Gout and Rheumatic Gout*, 1876, p. 500.

³ *Ib.* p. 515.

But in this case—and I believe this is true of the majority of such cases—the mental anxiety was, in my opinion, merely an indirect factor. No human being is more utterly regardless of hygienic laws, and especially of dietetic laws, than an anxious and unselfish woman : it seems to her almost a point of honour to disregard food, above all animal food, which she deems suited only to the stronger, coarser, and more active male. In the case to which I am referring, the patient, a girl of 20, already anaemic, lived, waking and sleeping, for some months in the tepid and oppressive atmosphere of her invalid mother's bedroom ; and during the whole of this time, bread and butter with tea, taken at frequent irregular intervals, was almost her only sustenance. In the neighbourhood in which she lives, 'rheumatism' is now regarded by many as 'catching.'

§ 850. FAT-FORMATION.—A rather well-marked inverse relation between the severity of the disease and the rate of fat-formation can be observed both at different periods of the one case and in different cases. Hyde says¹ :—'It may be taken as a safe conclusion, if there is gradual increase of weight, no matter how slight . . . that things are going well. On the other hand, if there is a gradual decrease, it is equally certain that matters are going ill. . . . I find it an almost infallible index.' That the salutary effect of increasing weight depends upon the decarbonizing influence of fat-formation, is, to my mind, almost assured by the fact that decreasing weight is an index of deterioration only so long as the patient continues to ingest a mixed diet, containing an excess of carbonaceous material. It is quite common to see cases *rapidly improve concurrently with decreasing weight, when placed upon a mainly proteid diet* ; and, later, I shall refer to cases in which all the pain and sub-inflammatory symptoms subsided completely upon the development of diabetes and cancer respectively—diseases which, in the cases referred to, were associated with marked loss of weight (§ 853).

§ 851. MENSTRUAL LIFE.—We have seen that women are peculiarly prone to develop hyperpyraemia (1) at the onset of puberty, especially when this is delayed : (2) before each menstrual flow : (3) whenever the menstrual flow becomes checked, or ceases through causes other than the absence of the inter-menstrual accumulation ; and (4) at the menopause

¹ *Rheumatoid Arthritis*, S. Hyde, 1896, p. 47.

(Chapter VI). With the view that rheumatoid arthritis is a manifestation of hyperpyraemia, the following observations are conformable.

Bannatyne says¹ of this disease:—‘In women, there are two great periods of life—the period of *puberty* and that of the *climacteric*’; and he points out that after the latter period is safely over, there is a sudden fall in the number of cases. There are no such marked variations in the age incidence of the disease in men.

Garrod says²:—‘Rheumatoid arthritis also occurs in young females labouring under catamenial irregularities, but it appears to me questionable whether any special stress can fairly be laid upon the uterine disturbance. The occurrence of the joint affection appears to be more dependent upon the accompanying depraved condition of the general system.’ Many of Garrod’s cases commenced about the time of the menopause. Harry Campbell³ describes a typical case of general rheumatoid arthritis associated with absence of menstruation for three months. The recurrence of increased pain just before, and at the commencement of, each menstrual period, is well marked in most cases: this was pointed out by Ord.

The commencement of the artificial menopause induced by the operation of double oophorectomy has, I believe, in some cases been marked by an outbreak of rheumatoid arthritis. This occurred in a case observed by myself.

The first effect of the operation was the reappearance of irregular, but intensely severe, sick-headaches: these ceased after a few months. Then suddenly rheumatoid arthritis, distinct but of quite moderate severity, affected both knees simultaneously: later, one thumb, both ankles, and both elbows became very slightly affected. After a few months, the pain and disability abated, though for a time she suffered from a subacute exacerbation at each menstrual epoch, which was still marked by a slight haemorrhagic discharge. Later still, the patient, who had throughout been stout, became obese: menstruation finally ceased, and the arthritic affection practically disappeared (Case XXVI).

§ 852. HAEMORRHAGE, LACTATION, AND PYREXIA.—Garrod says⁴:—‘Haemorrhage is a very frequent cause: hence the

¹ *Rheumatoid Arthritis*, 1898, p. 45.

² *Gout and Rheumatic Gout*, 1876, p. 515.

³ *Headache*, 1894, p. 213.

⁴ *Gout and Rheumatic Gout*, 1876, p. 515.

disease is not uncommon in cases of menorrhagia, but any other form of bleeding is equally powerful. It not unfrequently arises from rapid child-bearing or from too prolonged lactation.' Haemorrhage, if profuse or repeated frequently, leads, as we have seen, to anaemia and so to deficient combustion (§ 233), which is one important factor of hyperpyraemia. Rapid child-bearing and prolonged lactation, especially if, as so frequently happens in the poor, associated with deficient proteid intake, will be capable of leading to malnutrition of the nitrogenous tissues, to consequent deficient decarbonization, katabolic and anabolic, and so to hyperpyraemia.

Pyrexia, especially if prolonged, may lead, as already argued, to malnutrition of the nitrogenous tissues, deficient decarbonization, and hyperpyraemia (§ 230); and many cases of rheumatoid arthritis arise post-pyrexially. Bannatyne says:¹ 'About 55 per cent. of my cases, in which a definite cause is assigned, arise, I find, as a sequel of some infective disease, such as rheumatism, gonorrhoea, influenza, tonsillitis, typhoid fever, etc.' I have seen two cases in which the disease followed dengue. Spender says:² 'Osteo-arthritis so often follows rheumatic pyrexia that the one may seem only a postscript or appendix of the other.' With acute rheumatism, there would be a local, as well as a general, cause in operation. On the theory of hyperpyraemia, chronic rheumatoid arthritis following acute rheumatism would be strictly analogous to chronic bronchitis following acute bronchitis: in both cases, the acute affection might be supposed to leave a humoral factor (hyperpyraemia), and a local factor determining the nature and site of the hyperpyraemic manifestation.

§ 853. PATHOLOGICAL ACARBONIZATION.—Trousseau³ averred that migraine was common in the life histories of rheumatoid sufferers, and that it tended to abate before the arthritic affection developed. Spender says:⁴ 'Severe headaches of the megrim type are a frequent form of cerebro-spinal sympathy.' Suckling, speaking of migraine, says:⁵ 'In marked cases . . . the knuckles are thickened, the joints crack, and the knees can be felt to grate on movement.' Such

¹ *Rheumatoid Arthritis*, 1898, p. 26.

² *Osteo-arthritis*, 1889, p. 3.

³ *Clinical Medicine*, New Syd. Soc., vol. iv. pp. 409, 415.

⁴ *Osteo-arthritis*, 1889, p. 21.

⁵ *On Periodical Headaches or Migraine*, p. 7.

joint affections Suckling regards as gouty, but it is improbable that none are rheumatoid; for Hutchinson is of opinion that these two arthritic affections may be mingled together in all proportions. In several of my cases of migraine, there was a quiescent form of arthritis especially affecting the phalangeal joints of the hands: in one, general rheumatoid disease.

The association of rheumatoid arthritis with asthma has been noted by many writers. Spender¹ saw cases beginning 'with pronounced symptoms of bronchial asthma.' J. W. Malim, Resident Medical Officer at the Royal Mineral Water Hospital, Bath,² points out that, 'when a functional disturbance like asthma supervenes, the joint trouble subsides to a certain extent, only to reappear when the asthma disappears'; and he relates a case in illustration. In a case of my own, the inverse relation between rheumatoid arthritis and asthma was very clearly shown.

The patient was a lady of 39, long subject to hay-fever. In her, rheumatoid disease of a subacute type developed rather suddenly, first in one knee, then in the other, later in both ankles and elbows. She visited the hot springs in New Zealand, and, while there, obtained so much relief that she was able to walk a short distance moderately well. The lameness continued, however, until she was attacked with violent paroxysmal asthma, which became frequently recurrent and finally more or less continuous. From the onset of the asthma, the rheumatoid affection ceased to cause pain or even discomfort: this change was sudden, complete, and practically simultaneous with the first asthmatic paroxysm; also, it was seemingly permanent, since she has suffered no pain or arthritic disability during the last two years. The traces of the rheumatoid outbreak are still, however, clearly perceptible in the roughness of the articular surfaces, especially marked on the posterior surfaces of the patellae (Case XXXVI).

Charcot says:³—'Heberden's rheumatism' (rheumatoid arthritis limited to the terminal phalanges of the upper extremity) 'is often accompanied by asthma, migraine, neuralgia, especially of the sciatic nerve, and muscular rheumatism. These manifestations may alternate moreover with the exacerbations of the disease.'

It seems probable that in a few cases gastralgic attacks, indicating partial acarbonization, are associated with rheuma-

¹ *Osteo-arthritis*, 1889, p. 26.

² *Brit. Med. Journal*, February 14, 1903.

³ *Lectures on Senile Disease*, Charcot, New Syd. Soc., p. 198.

toid arthritis : Spender¹ saw cases beginning with 'gastric crises.'

The last-mentioned writer says :²—'The association of tubercular consumption with nodular arthritis in the same family (though not in the same children) is so remarkable, that a trustworthy clue is afforded when the nature of the arthritis is not at first quite evident.' If it be true, as I have ventured to suggest, that hyperpyraemia constitutes a humoral factor in some cases of pulmonary tuberculosis, then the association to which Spender calls attention might receive a partial explanation. But the association might be explained without importing the factor of hyperpyraemia. Common family food habits would be sufficient : Bauer has, as already mentioned (§ 691), pointed out that the commonest antecedent food fault in cases of phthisis is a deficiency of proteid with an excess of carbohydrates ; and we have seen that this is true of many cases of rheumatoid arthritis.

Dr. Hawkes tells me of a case of undoubted and severe rheumatoid arthritis which he attended for some time : diabetes supervened, and from its onset all pain in the disabled joints disappeared somewhat suddenly. I have seen the same happen on the supervention of malignant disease of the liver, in a case of rheumatoid polyarthritis.

§ 854. UNRELIEVED HYPERPYRAEMIA.—Very many affections, which in this work have been regarded as indications of attempted acarbonization or manifestations of unrelieved hyperpyraemia, are found in conjunction with undoubted rheumatoid disease. Some of these are certainly vaso-motor : others are explicable on the hypothesis that they consist of pathological vaso-motor action : in others again, the mechanism is less clear.

Four, at least, of my own cases of rheumatoid arthritis suffered from occasional paroxysms of typical angina pectoris during the progress of the articular disorder, and in some of these the paroxysms had preceded the rheumatoid outbreak (Case XXXVI).

Dr. Llewellyn Jones calls attention to the close relationship existing between vaso-motor action and the joint changes in rheumatoid arthritis. He says :³—'Local syncope may occur in a finger which subsequently develops spindle-joints' : he has

¹ *Osteo-arthritis*, 1889, p. 26.

² *Ib.* p. 21.

³ *Brit. Med. Journal*, November 29, 1902, p. 1744.

known the symptoms follow each other in three weeks : finally he says, the joint changes and the vaso-motor phenomena vary concomitantly. Raynaud's phenomena may also be seen in 'those¹ cold clammy blue hands, evidently a local asphyxia, with sweating of the palms, pigmentation, etc.' (Bannatyne). Associated therewith are other symptoms, such as extreme sensitiveness to cold draughts, which may be taken to indicate extreme irritability of the vaso-motor system (compare § 515).

Spender refers² to 'evanescent blushings and blanchings of the skin.' Such may occur in the skin over affected joints : the former are commonly associated with an increase of articular pain, and are apt to follow within an hour or so of meals : the latter come later, bring relief from pain, and seem to be reactionary. Hyde³ notes that articular enlargement, oedema, and pain 'may be worse at nights and after meals' ; at which times, we have seen, hyperpyraemia is most likely to be present. It must be said, however, that all meals are not equally prone to cause this symptom : breakfast seems usually free from this tendency in the case of rheumatoid joints, just as, we have seen, it is free from any tendency to precipitate asthmatic paroxysms (§ 314) : the harmlessness of breakfast in either case is probably explained by the rapid rise of combustion which succeeds the meal and anticipates hyperpyraemia. Further, a small meat meal at lunch or dinner-time will lead to no post-prandial discomfort, while a heavy mixed meal, or even a heavy carbonaceous meal, especially one containing much sugar or alcohol, will almost infallibly add to the sub-inflammatory arthritic symptoms. There seems little doubt, therefore, that hyperpyraemia, even if it does not constitute a factor in rheumatoid arthritis, is distinctly aggravative of the disease when developed.

It has been argued that recurrent oculo-motor paralysis may be, in some cases at least, a manifestation of hyperpyraemia (§ 487) ; and Llewellyn Jones⁴ calls attention to the tendency that rheumatoid patients have to possess coincidently peculiar, and often fleeting, ocular palsies. Angio-neurotic oedema which, we have seen, may be associated with migraine, asthma, gout, and other manifestations of hyperpyraemia, 'has been noticed in rheumatoid disease'⁵ (Bannatyne). Garrod

¹ *Rheumatoid Arthritis*, Bannatyne, 1898, p. 124.

² *Osteo-arthrosis*, 1889, p. 19.

³ *Rheumatoid Arthritis*, 1896, p. 14.

⁴ *Brit. Med. Journal*, February 14, 1903, Letter by J. W. Malim, M.B.

⁵ *Rheumatoid Arthritis*, G. A. Bannatyne, 1898, p. 123.

saw¹ ‘a very large number of cases in which psoriasis has been present at the same time that the joints have been implicated’: psoriasis is recognized as one of the commonest manifestations of abarticular gout, which we are regarding as synonymous with hyperpyraemia (§ 820). Of eczema, another common hyperpyraemic manifestation, Garrod² saw some few cases associated with rheumatoid disease; but he regards this cutaneous affection as much more commonly present in true gouty cases. In Queensland, eczema has seemed to me quite common in the rheumatoid affection: the difference is possibly due to climatic reasons.

§ 855. PROXIMATE FACTOR OF THE JOINT CHANGES.—The view that hyperpyraemia constitutes a humoral factor in rheumatoid arthritis does not seem to throw much light upon the proximate factor or mechanism of the joint changes. The most obvious hypothesis, considering everything, is that this consists of pathological vaso-motor action: this has had more than one advocate. Fosbrooke³ thinks that anaemia ‘is responsible for the joint and other changes. He states that at first, owing to a deficiency of oxygen in the blood, the vaso-motor centre in the medulla is stimulated, and by consequent constriction of the minute vessels supplying the joints and smaller nerves, the nutrition of these parts is interfered with. This deprivation of blood . . . although at first functional in nature, may give rise to organic changes. The stimulation of the vaso-motor centre, if prolonged, ends in exhaustion, followed by dilatation of the joint-vessels and inflammation.’ Bannatyne points out that this theory breaks down because, in many cases, the anaemia only supervenes subsequently to the arthritic outbreak. This objection, however, would not apply to hyperpyraemia, which may occur conjointly with, or independently of, anaemia; and bearing in mind the vaso-motor consequences so common in hyperpyraemia, some such explanation as Fosbrooke’s might still hold: at any rate, the rapid development of a spindle-joint in a finger which has been the seat of local syncope, as noted by Llewellyn Jones, is certainly suggestive of a vaso-motor mechanism.

But the disproof of the vaso-motor hypothesis would by no means demand the abandonment of hyperpyraemia as a

¹ *Gout and Rheumatic Gout*, 1876, p. 522.

² *Ib.*

³ *Rheumatoid Arthritis*, Bannatyne, 1898, p. 16.

humoral factor in rheumatoid arthritis ; nor would the demonstration of an essential microbial factor. For it might be that the unphysiological condition of the blood implied in hyperpyraæmia leads directly to malnutrition of the joint structures, or constitutes the predisposition for microbial invasion and infection. Finally, it is possible that hyperpyraæmia, when prolonged, becomes associated with complex toxic conditions, and that some of these are the essential humoral factors of rheumatoid arthritis.

§ 856. TREATMENT.—Hyde says :¹—‘ Rheumatoid arthritis being essentially a disease of malnutrition of the joint structures and also of general debility, all treatment must be directed to the improvement of the nutritive process.’ If, as seems probable from the evidence adduced, the malnutrition depends upon, or even is associated with, and aggravated by, hyperpyraæmia, then the therapeutic measures most likely to be successful will be readily deducible. It should be premised that one of the most natural and effectual means of decarbonization, namely physical exercise, is, in the majority of cases, greatly restricted. Accordingly, we shall have to adopt, in the first instance at least, measures which restrict the carbonaceous income, while they increase the decarbonizing capacities of the tissues, katabolic and anabolic. Dr. Macalister² says that some cases have been greatly ameliorated by the administration of thyroid gland ; and thyroid gland is known to increase the rate of combustion. I have, however, no experience of the drug in this disease.

The treatment I have found most valuable comprises an abundance of fresh air in a cool or cold climate : exercise short of fatigue and short of injury, even temporary increase of pain in the affected joints : general massage, especially where exercise is impossible : cold bathing, local and general, perhaps preceded by very short, hot, douches to the affected joints ; and a dietetic prescription which, while almost precluding carbohydrates, increases the proteids, and to some extent the fats, especially perhaps butter and cod-liver oil. Most of these measures are clearly in accord with the theory of hyperpyraæmia : none of them are necessarily inconsistent therewith. It may be that the increase of fats—which, it may be said, seems in a

¹ *Rheumatoid Arthritis*, 1896, p. 41.

² *Brit. Med. Journal*, November 21, 1903, pp. 1334, 1335.

few cases injurious—is inconsistent with the theory of hyperpyraemia. It may be, on the other hand, that it is not so; for it is possible that the tissues have assimilative powers over some fats, which powers are defective when applied to some other carbonaceous materials (compare § 126).

The dietary recommended—which is, in my opinion, more important than all the remaining items of the treatment, put together—is not dissimilar to what is advocated by authors of wide experience. Garrod says:¹ ‘Meat should form a considerable portion of the diet.’ Bannatyne says:² ‘The practice of limiting the amount of nitrogenous food is not beneficial—I should prefer to say that it is, as a rule, highly injurious, and may be disastrous—‘in fact as much nitrogenous food as can be digested should be given.’ He appends a diet scale in which he is careful to point out that such articles as bread, rice, and potatoes should be taken sparingly. It is very important in my opinion to exclude the use of sugar and all articles of food containing sugar.

The great majority of cases of chronic rheumatoid polyarthritis come under the notice of the physician only after irreparable damage has occurred in the joints affected. In such, it is not possible to do more than relieve pain, prevent the further extension of the disease, and perhaps obtain some improvement in the condition of the articular structures already damaged. But I do not hesitate to say that this result is possible of achievement in nearly all cases, provided that treatment on the lines laid down is persevered in consistently and uninterruptedly for a prolonged period. Such, at any rate, is my experience, and this is now by no means small or entirely impersonal.

But, fortunately, a small proportion of rheumatoid cases do apply for treatment in a comparatively early stage of the disease; and in many of these there can be no question that the disease is curable, and curable in an almost strict sense of the term. I have had at least three cases (two of these are detailed in the Appendix) in which the diagnosis was beyond suspicion of error, and in which consistent treatment, for from six to nine months, eventuated in the complete recovery of health, strength, and activity (Cases LXIX and LXX). But everything depends upon continuity of treatment; and this is

¹ *Gout and Rheumatic Gout*, Garrod, 1876, p. 540.

² *Rheumatoid Arthritis*, Bannatyne, 1898, p. 132.

never possible without the full and hearty—I had almost said, enthusiastic—co-operation of the patient. More, I think, than on anything else, the prognosis depends upon the intelligence and determination of the patient. Neither quality is universal. The former, at least, is more likely to be met with in private, than in hospital, practice; and treatment in most hospital patients is apt to be discouraging. The latter quality, I find, deteriorates very rapidly under the influence of morphia. Hence, if for this reason alone, it is almost fatal to succumb to glide into the practice of giving hypodermic injections for the relief of pain. But I am inclined to think that opiates of any kind exercise a directly injurious influence through retarding combustion. (Compare § 393.)

SOME ATYPICAL JOINT CASES

§ 857. In speaking of rheumatoid arthritis, I have had chiefly in mind cases which begin insidiously without apparent proximate cause, affect a large number of joints in succession, and tend to be chronic and progressive in their course. Such cases seem easily differentiable from gout, on the one hand, and from acute rheumatism, on the other. But there is a large residuum of cases which are atypical. Some of these are monarticular: some commence acutely or subacutely: some remain as a legacy from typical acute rheumatism; and some are found in cases which have suffered from true gout in other articulations. Here I am only referring to these indefinite cases to gain an opportunity to state that, in some, hyperpyraemic conditions, or the causes or results of these conditions, seem to enter largely into causation. For now and then—and this with increasing frequency—a line of treatment deducible from the theory of hyperpyraemia has given in my hands results which are unmistakable. At present, however, I am unable to foresee the result in any individual case.

There are many indications that the trend of modern medical thought is strongly towards a hyperpyraemic pathology for gouty and rheumatic affections generally. It has been argued that hyperpyraemia may arise primarily through over-carbonization, or through deficient decarbonization (Chapter VII); and conformably with both views, Porter considers¹ that

¹ *American Year-book of Medicine and Surgery: Medicine, 1902*, p. 93.

'the two great predisposing factors in the development of so-called gout and rheumatism, are the prolonged intake of a larger amount of nutritive pabulum than the system can perfectly oxidize, or conditions that so reduce the oxygenating capacity of the animal economy, that the small amount of food taken cannot be perfectly oxidized.'

THE GOUTY OR URIC-ACID DIATHESIS, LITHAEMIA, ARTHRITISM, ETC.

§ 858. Unless I have pursued throughout this work a fundamentally fallacious argument, it should now be abundantly apparent that the manifestations of the so-called gouty or uric-acid diathesis, lithaemia, arthritism, etc., are simply the manifestations of hyperpyraemia, and indicate, for the most part, processes of acarbonization, or of attempts at acarbonization. If so, there will be no room in medical nosology for any of these terms in the wide and inclusive sense in which they have hitherto been employed. But we shall not be precluded from retaining their use in a more restricted sense. We might, for example, retain the terms 'gouty diathesis' and 'arthritism' to denote a tendency on the part of the organism to terminate hyperpyraemia by deposition of uric acid in the joints and consequent pyrexial acarbonization—a tendency to articular or true gout in short. And the 'uric-acid diathesis' and 'lithaemia' we might retain to denote a tendency to uro-lithiasis or calculus. Similarly, we might retain the terms 'herpetic diathesis' and 'herpetism' to denote a special tendency to the cutaneous manifestations of hyperpyraemia. On this understanding, diatheses, whether hereditary or acquired, would refer, as hitherto, to *functional* factors; but these would occupy a position secondary to the humoral or *supply* factor—the position of determining the direction and form of pathological acarbonization, or of the manifestations of unrelieved hyperpyraemia.

It may be advisable, however, to adduce some further evidence that all the seemingly diverse clinical conditions included under the terms gouty or uric-acid diathesis, lithaemia, and arthritism, depend fundamentally upon hyperpyraemia. To this end, it would be easy to adduce a mass of clinical evidence which would show the salutary influence upon the morbid conditions embraced in these terms, of physiological,

pathological, and therapeutic methods of acarbonization, whether such act by diminishing income, by increasing expenditure (anabolic, not less than katabolic and haemorrhagic), or by both means combined. Such an enumeration, however, would be almost interminable, and space is lacking. Here it is only possible to adduce a few peculiarly significant pieces of evidence under the heads of symptomatology, pyrexia, oxygen, and food.

§ 859. SYMPTOMATOLOGY.—Charcot¹ says of the uric-acid diathesis :—‘The fundamental point is a peculiar dyspepsia, the commonest symptoms of which are flatulence and distension of the stomach, gastric acidity, and pyrosis. At the same time, there is a bitter taste in the mouth and the tongue is dry and furred: almost always constipation is to be observed. The liver seems also to participate in the disturbance of the digestive apparatus; it is often swollen, and reaches beyond the margin of the false ribs; sometimes one notices a half icteric tint, and the scanty stools are grey and discoloured. Fairly pronounced nervous phenomena accompany this dyspeptic state and may even exist independently of it.’ Garrod affirms that the dyspepsia common in the uric-acid diathesis may be associated with hepatic enlargement: he mentions² ‘a feeling of distension in the epigastrium, at times accompanied with tenderness,’ and ‘some fulness over the hepatic region, the edge of the liver projecting a little below the ribs.’ All such cases of dyspepsia receive a simple explanation on the view that they are secondary dyspepsias and depend upon glycogenic distension of the liver.

Murchison’s lithaemia is regarded by most writers as identical with the gouty and uric-acid diatheses. The commonest symptoms are thus enumerated by Murchison:³—
a. A feeling of weight and fulness at the epigastrium and in the region of the liver.
b. Flatulent distension of the stomach and bowels.
c. Heartburn and acid eructations.
d. A feeling of oppression and often of weariness and aching pains in the limbs, or of insurmountable sleepiness after meals.
e. A furred tongue which is often large and indented at the edges, and a clammy, bitter, or metallic taste in the mouth, especially in the morning.
f. Appetite often good; at other times, anorexia

¹ *Lectures on Senile Diseases*, Charcot, New Syd. Soc., p. 70.

² *Gout and Rheumatic Gout*, 1876, p. 232.

³ *Functional Derangements of the Liver*, Murchison, 1874, pp. 68, 69.

and nausea. *g.* An excessive secretion of viscid mucus in the fauces and at the back of the nose. *h.* Constipation . . . occasionally attacks of diarrhoea, especially if the patient be intemperate in the use of alcohol. *i.* In some patients attacks of palpitation of the heart, or irregularity or intermission of the pulse. *k.* In many patients, occasional attacks of frontal headache. *l.* In many patients, restlessness at night and bad dreams. *m.* In some patients, attacks of vertigo or dimness of sight, often induced by particular articles of diet.'

Now all the symptoms enumerated—and the list might be extended almost indefinitely—may reasonably be explained by hyperpyraemia, by associated pathological vaso-motor action, or by associated pathological distension of the liver and consequent secondary dyspepsia, gastric and intestinal. Further, many of the more formal affections, such as migraine, asthma, angina pectoris, epilepsy, etc., which Murchison connected more or less directly with functional derangements of the liver, have been argued by us to depend, in many cases, primarily on hyperpyraemia.

To me it seems that Murchison's synthesis failed by hardly more than one step. While he saw plainly that many of the gastric and intestinal symptoms depend on the hepatic condition, he failed to see that the hepatic condition depends in turn upon a blood condition. Hence he was led to regard the blood-state as a result of the liver-state, thus transposing cause and effect.

§ 860. In a comprehensive *résumé* of the manifestations of arthritism in children, J. Comby¹ enumerates practically all the affections which we, in this work, are ascribing to hyperpyraemia. Children so affected easily take cold and often suffer from rhino-pharyngitis and tonsillitis: the lymphoid tissue is in excess and readily proliferates. They are emotional, irritable, liable to giddiness and even syncope, and vaso-motor derangements, such as pallor and blushing, follow slight causes. Spasmodic coryza, occasionally rising to recurrent nasal asthma associated with haemorrhage, may follow slight changes of temperature: in fact, epistaxis is common, especially on the approach of puberty and in summer. Laryngismus stridulus frequently follows slight chills, and is associated with

¹ *The Medical Review*, May 1902, abridged from *Archives de Médecine des Enfants*, January and February 1902.

enlarged tonsils and adenoids. Bronchitis is common and often markedly asthmatic: it may occur twice or thrice yearly and be pyrexial or apyrexial. Dyspnoeal crises may alternate with urticarial or eczematous eruptions: occasionally an attack of asthma seems to replace one of obstinately recurrent eczema; and acute pulmonary congestion may appear and disappear with rapidity.

Many of these children suffer from anorexia, with coated tongue and foetid breath: dyspepsia of all kinds, colic, and febrile gastritis are common. Constipation is the rule: it predisposes to mucous enteritis and other intestinal disorders. 'Digestion fever' may occur every two or three months. Cyclic vomiting is another symptom: the attacks are sudden and recur at short intervals of three or four days: there may be pyrexia, headache, and restlessness: meningitis suggests itself, but the vomiting ceases as suddenly as it appeared and the patient rapidly becomes well: after some weeks, the symptoms recur: the only treatment necessary is rest in bed and *the withdrawal of all solid food, even milk.*

Temporary albuminuria may occur: uric acid may be in excess, with cystitis and urethritis; and renal, and subsequently vesical, calculus may eventuate. Later in life, dysmenorrhoea and menorrhagia are not uncommon, and have long been recognized as characteristic of a gouty tendency (compare § 668 *et seq.*).

Nervous disorders are very common. Insomnia may be constant: eclamptic seizures may occur in such as are apparently healthy, and may give place with advancing years to other nervous manifestations, such as night terrors. Migraine is very prevalent: 'headache is so varied, persistent, and inveterate, that a whole article might well be devoted to it.'

The cutaneous affections are very varied: chilblains are common in winter: abundant perspirations, miliaria, sudamina, dysidrosis, and erythema, in summer. Urticaria, whatever its proximate cause, is a frequent arthritic manifestation; and acute oedema of the eyelids—a variety of angio-neurotic oedema—may occur suddenly and recur periodically every few months. Seborrhoea, keratosis pilaris, xerodermia, psoriasis, and acne punctata are equally frequent, but the most common dermatosis is gouty eczema. 'The rule is for such children to manifest, after the eczema has disappeared, other evidences of

gout, particularly asthma and migraine. . . . The writer thinks that asthma is liable to replace the eczema on the sudden disappearance of the latter.'

There may be 'articular manifestations, independent of any acute rheumatic condition. These are subacute or chronic. Some of the joints may creak and stiffness may be followed by ankylosis and non-inflammatory swellings. . . . All these pseudo-rheumatic, or rheumatoid, manifestations are usually apyretic. They resemble gout rather than rheumatism. But typical attacks of gout may occur in children.'

Let anyone who has so far followed the argument set forth in these pages ponder on each item of this seemingly lengthy, yet all too short, list of morbid symptoms and affections; and he will not, I think, be able to resist the conclusion that all, without exception, are explicable by hyperpyraemia, by secondary uricaemia, by the pathological vaso-motor action to which hyperpyraemia may give rise, or by the pathological distension of the liver and consequent circulatory block in the digestive mucosae which are such common expressions of hyperpyraemia. Of course, it is unnecessary to add, the varying manifestations of the humoral factor in different cases are determined by variations in the personal factor and in environing factors.

§ 861. DIURNAL FLUCTUATION OF COMBUSTION.—Duckworth¹ calls attention to 'the fact that not only acute attacks of gout are apt to supervene during the hours allotted to sleep, but that other less severe gouty manifestations likewise occur during the night, or are found to have come on at that period. . . . The patient retires to bed feeling in his usual health, but on awaking in the morning he discovers at once some new phase of his malady; it may be muscular pain or stiffness, angina of the fauces, the beginning of a hemicrania, or more or less severe pain in some joint or adjacent texture, such as a stiff neck, lumbago, or a burning phalangeal joint. These troubles or some of them have come on in the night, but have not been sufficient to disturb sleep. Cramps in the calves of the legs are especially prone to vex gouty persons at night, and sometimes for several nights precede a severe attack. . . . Epilepsy, neuralgia, spasmodic asthma, gastralgia, angina pectoris, laryngismus stridulus, and hemicrania, are all prone

¹ *Treatise on Gout*, 1890, Duckworth, p. 281.

to disturb sufferers during the early hours of sleep, or immediately on awaking. In all these cases, we have to seek for a cause which determines these outbreaks with such marked constancy in connexion with the sleeping state.'

We have, I think, already seen sufficient evidence that the common cause foreshadowed by Duckworth is the heavy fall in the rate of combustion during sleep, and the consequent occurrence of nocturnal hyperpyraemia, or tendency thereto.

§ 862. PYREXIA.—A constant, or recurrent, tendency to uro-lithiasis is accepted as one of the commonest signs of the 'gouty diathesis'; and we have seen that pyrexia is one of the most efficient of the pathological acarbonizing processes. Hence we shall not be surprised to learn that even short pyrexial attacks are capable of exerting a beneficial influence upon the gouty diathesis. Conformably, Heinrich Stern contributes to the pages of 'American Medicine' (May 25, 1901)¹ a paper entitled 'The Beneficial Effects of Vaccination on the Gouty Diathesis.'

In the first case mentioned, a man of 50 suffered from lithaemia for a number of years. The paroxysmal attacks caused great suffering, and were with difficulty kept under by an anti-lithaemic diet, iodide of potassium and colchicum. He remained free from pain as long as he took the medicines. Discontinuance of the latter, even for but two or three days, although he strictly adhered to the prescribed diet, inevitably brought back the gouty pains. In December 1900 he was vaccinated for the third time. On the seventh day, when he had moderate fever and felt himself indisposed, he stopped medicine. The fever continued for about four days. In January 1901, about five weeks after vaccination, he stated that he had not taken any medicine for a month and that he had been entirely free from pain. In the second case, revaccination accompanied by considerable swelling of the axillary glands in a man of 50, suffering from chronic interstitial nephritis, dispersed severe paroxysmal pains of a neuralgic character in the region of the psoas and glutei muscles. In a case of diabetes, vaccination dispersed spasmodic contractions of the muscles of the calves. In another, gouty pains in the ankles and toes were similarly benefited. In Case V, a woman, aged 26, complained of distressing sensations in the muscles of the back, and of an intense tired feeling in the lower limbs. She was vaccinated, the febrile period was nearly a week in duration, and the temperature rose to 104·9. Before the complete abatement of the acute phenomena, the original muscular pains and the languor vanished and did not recur.

¹ Reviewed in the *Medical Record*, August 1901.

Such results speak for themselves ; and they suggest a large extension of the treatment by seton or by the plan of injecting sterilized turpentine into the subcutaneous tissue (§ 806).

§ 863. OXYGEN.—The acceleration of combustion which, we have inferred, follows the administration of oxygen, has been found of benefit in the ‘gouty diathesis.’ In the following case, the remedy was introduced per rectum. Kellogg¹ ‘reports the case of a man of 28 who was passing large quantities of uric acid, although restricted to a non-nitrogenous diet and drinking from three to five pints of hot water per diem. His skin was very muddy, sclerotic dingy, tongue heavily coated, and he complained of a constant and very annoying brassy taste in the mouth. There was also a distressing and persistent headache : in short, all the symptoms of mild uric acid poisoning. Two litres of oxygen were introduced, per enema, daily at 10 A.M. Within three days the excess of uric acid entirely disappeared from the urine, reappearing twice afterwards in small quantity, when the injections had been temporarily omitted. The brassy taste and cephalalgia both promptly disappeared.’ This case illustrates the futility of attempting to disperse uricaemia by large draughts of hot water, as well as the success of acarbonization through exaggerated combustion.

§ 864. FOOD.—The evidence under this head seems to me conclusive.

Dr. W. Bezly Thorne² gives his own most significant personal experience. Twenty years ago, he found himself slowly, but steadily, declining in health, with painful enlargements of the articular ends of bone, especially of those of the hands and feet, periosteal inflammations of parts subjected to any kind of violence, migraines, decline of appetite and digestive power, together with excretion of uric acid steadily increasing in frequency till it became a matter of daily occurrence. Under professional advice, he steadily diminished the amount of nitrogenous food, more especially of meat, until for twelve months not a shred of butcher’s meat had passed his lips, and but little of either chicken or fish. His condition, however, went from bad to worse. Finally, he resolved to

¹ *Oxygen and other Gases in Medicine and Surgery*, Demarquay and Wallian, pub. F. A. Davis, 1889, pp. 219, 220.

² *Lancet*, April 11, 1903, p. 1059.

exercise the courage of opinions which had long been maturing, and to do the exact opposite in the way of *régime* of what he had been taught and told to do. He placed himself upon a dietary which might be called of the strictest diabetic type, and in two or three weeks he found himself in the enjoyment of a state of health and vigour that he had not known for years, and which has been maintained, under similar conditions of diet, to the present day, with conspicuous absence of all the painful symptoms from which he previously suffered. This personal experience naturally led him to prescribe similar treatment in numbers of his patients who were similarly affected. After twenty years of such practice, he describes his results as conspicuously successful.

In an address on ‘Hepatic Inadequacy and its Relation to Irregular Gout,’ Burney Yeo says:—‘A vegetarian diet may suit some, but it has not fallen to my lot to meet such cases. But I am bound to admit that I have seen most troublesome gouty headaches disappear, and a condition of greatly improved health result, from an exclusive, or nearly exclusive, diet of pounded meat with liberal draughts of hot water. I have rarely prescribed this diet myself, but I happen to have been officially brought into contact with those who have been following this mode of treatment, and I have not been able to resist the evidence of its success in some cases; and although in one instance the patient seemed at first to be made very weak and thin, yet he was free from headaches, and, after perseveringly following the treatment for some months, ended by finding himself in better health than he had been for many years.’

The success of the Salisbury treatment in such cases is, in my opinion, the strongest evidence of the truth of the theory of hyperpyrexia. The carbonaceous intake is reduced, relatively to the total intake, to the possible extreme, and simultaneously the decarbonizing capacities of the tissues are largely increased through the surplus of nitrogenous material.

It is customary, at the present time, to refer many cases of gouty dyspepsia, etc., to hepatic *inadequacy*: but Murchison surmised that persons so affected suffered from ‘too much liver.’ The view here taken approximates closely to Murchison’s; for the manifestations of gouty or hepatic

¹ *Brit. Med. Journal*, June 5, 1901.

dyspepsia must be regarded as evidence of hepatic *adequacy*—of adequacy of the glycogenic function, that is to say: hence the complete subsidence of all such manifestations which almost invariably occurs on the supervention of glycosuria, an expression of *inadequacy* on the part of the glycogenic function of the liver.

§ 865. It is interesting to speculate how it has come about that gout has been selected to give a name to a diathesis in preference to affections like migraine, asthma, and epilepsy. If, as I believe, all may be acarbonizing processes dependent on hyperpyraemia, why, instead of the gouty diathesis, have we not had migrainous, asthmatic, and epileptic diatheses? The answer to this question does not seem far to seek.

The neurosal acarbonizing processes referred to are prone to arise early in life, to recur frequently, and to persist over long periods without material modification. Hence, in persons so affected, the inter-paroxysmal periods of hyperpyraemia are comparatively short, and the manifestations of hyperpyraemia are for the most part limited to the special acarbonizing process in question. Gout, on the other hand, is, as has been argued (§ 612), essentially the acarbonizing process of those who lack the pathological capacities needful for neurosal acarbonization: it arises, as a rule, in middle or advanced life: for its production, comparatively long periods of hyperpyraemia are necessary; and it recurs with comparative infrequency. Hence those who acarbonize by frank articular gout will be prone to suffer during the inter-paroxysmal periods from many of the minor alternative manifestations of hyperpyraemia, to a much greater extent than those who acarbonize by any of the paroxysmal neuroses. And all the clinically diverse minor manifestations—amongst which will often be minor representatives of the overt paroxysmal neuroses, such as congestive headaches, hemicranias, neuralgias, slight asthmatic dyspnoeas, and synapses and vertigos suggestive of epilepsy—will evaporate and vanish before the pyrexial storm of the arthritic paroxysm. It is natural, therefore, that all the inter-paroxysmal hyperpyraemic disorders should have been ascribed to goutiness, and that they should have been included under the gouty diathesis.

CLASSIFICATION OF THE MANIFESTATIONS OF UNRELIEVED HYPERPYRAEMIA

§ 866. We have seen reason to believe that hyperpyraemia always involves a degree of uricaemia, which, in some cases, becomes clinically prominent. This uric-acid factor may be conveniently used as a primary distinction in classifying the manifestations of unrelieved hyperpyraemia. Amongst these, uric acid becomes prominent only in articular gout ; to which may, perhaps, be added some cases of uro-lithiasis, calculus, etc. In the remaining manifestations, uric acid apparently plays no important part. These may be classified on a regional basis, such indeed as we have already used. They will include the vascular, respiratory, nervous and psychical, cutaneous and articular manifestations ; but this classification will be clinical rather than pathological, since, as already stated (§ 770), most respiratory manifestations are primarily vascular ; and the same is probably true of other manifestations, such as some cutaneous affections, urticaria, etc. The subjoined table shows a classification drawn up on this basis.

SUMMARY

§ 867. In this chapter, I have argued that subacute and chronic articular gout depend, like acute gout, upon extra-vascular deposition of uric acid from uricaemia, secondary to hyperpyraemia, but that, the pyrexial element being inadequate or wanting, such attacks are not self-curative, and, therefore, tend to be prolonged, to induce progressive articular disorganization, and to be associated with all the manifestations of unrelieved hyperpyraemia and the ultimate results of this humoral condition : that the terms gouty, or uric-acid, diathesis, lithaemia, arthritism, etc., embrace all the manifestations of hyperpyraemia, whether acarbonizing processes or other, and that they are, therefore, misnomers, since they tend to emphasize unduly the secondary humoral condition uricaemia and the clinical conditions of which uricaemia is the proximate cause ; and that the obscure arthritic affection termed rheumatoid arthritis, and some other arthritic affections, even more obscure because atypical, probably depend in part upon some of the factors of hyperpyraemia, upon hyperpyraemia, or upon some of the results of hyperpyraemia.

TABLE VIII.

Unrelieved hyperpyrexia perhaps usually associated with unrelieved uricaemia.

Uric-acid factor prominent.		Uric-acid factor latent or inconspicuous.	
Subacute and chronic articular gout.	Uro-lithiasis, calculus, etc.	Hepatic.	Vascular.
			Persistent high blood-pressure, angina pectoris (some cases). Raynaud's disease and all hyperpyrexic vaso-motor affections, not amounting to acarboinizing processes.
		Respiratory.	Chronic bronchitis and chro-nic catarrhs of many kinds.
		Psychical.	Neurasthenic conditions, some cases of insanity.
		Cutaneous.	Some cases of eczema, acne, psoriasis, urticaria, etc.
		Articular.	Rheumatoïd ar-thritis (?) and some atypical joint cases.

CHAPTER XXIV

§§ 868–905

Hyperpyraemic degenerations—Arterial degeneration : the humoral factor : the mechanical factor : the conservative view of arterial disease : arterial disease, a premature physiological degeneration—Cardiac degenerations : enlargement : valvular affections—Venous degeneration—Renal degeneration : evidence of hyperpyraemia, antecedent and co-existent : suggestions as to the mechanism of renal cirrhosis : general conclusions as to the pathology of renal cirrhosis : renal cirrhosis, a premature physiological degeneration—The meaning and mechanism of the high blood-pressure of renal cirrhosis : the polyuria of renal cirrhosis—Arterio-sclerosis and renal cirrhosis collocated and differentiated : confirmatory views and observations—Classification of hyperpyraemic degenerations.

§ 868. In very general terms, it may be stated that pathological acarbonization, even when obviously salutary, is costly to the organism in that it tends to perversion and loss of function and to premature degeneration. The nature, localization, and extent of the degeneration will vary widely in accordance with a variety of circumstances : it will vary in accordance with the great diversity of the conservative devices adopted by different organisms, a diversity which, as has been argued, depends upon a multitude of factors, extrinsic and intrinsic (Chapter XIII).

In *migraine*, the sensory structures are chiefly affected : hence, as Anstie¹ pointed out, recurrent migraine tends to pass finally into a more or less chronic neuralgic condition. In *asthma*, the bronchial mucosae are affected : hence recurrent asthma tends to pass into chronic bronchitis with gross organic changes in the bronchial tubes, chronic expansion of the chest, and emphysema. In *angina pectoris*, the walls of the heart are affected ; and angina leads, in not a few cases, to organic weakness of the heart. In *epilepsy*, degeneration and loss of function affect mainly those portions of the cerebrum which concern the

¹ *Neuralgia*, 1871, p. 121.

higher mental functions: Dr. William Spratling,¹ Medical Superintendent of the Craig Colony for Epileptics, New York, states that mental enfeeblement or dementia occurs in fully 90 per cent. of all cases of epilepsy, when the disease has been in existence some years. But the motor and sensory centres are also affected: hence paretic and paraesthetic phenomena, temporary or permanent, are common in epileptics.

Since the paroxysmal neuroses are vaso-motor, or vaso-motor plus cardio-inhibitory, in mechanism, we may ascribe the degeneration which is liable to ensue in cases so affected, proximately to the vascular or circulatory factor: in other words, the conservative circulatory devices, instituted by the organism to disperse the humoral condition, will often be the determining factors of the ultimate degeneration.

In other cases, the proximate determining factor of the degeneration will not be vascular. In acute gout, the conservative agent is the pyrexia: in proportion as pyrexial reaction is marked, so is the self-curability of the attack. But in chronic gout, pyrexia is absent: hyperpyraemia, uricaemia, and uratosis, persist; and articular disorganization supervenes. Here, although its localization depends upon the original conservative gouty paroxysm, the subsequent degeneration must be regarded as due, in the main, to the ultimate failure of such conservative action.

The same is largely true of pathological acarbonization of all kinds. As we have seen, cases are common in which recurrent neurosal acarbonization of long duration ultimately ceases to be efficient. Bilious, migrainous, and gastralgic attacks are prone in the long run to lose their anorexia, vomiting, and dyspeptic symptoms: in asthmatic and epileptic fits (rarely in the latter), the muscular action may become feeble: in short, the conservative features of acarbonizing paroxysms are apt to wane progressively. When such happens, the manifestations of recurrent hyperpyraemia graduate into, and become more and more replaced by, the manifestations of continuous or unrelieved hyperpyraemia: in other words, hyperpyraemia becomes continuous because recurrent acarbonization becomes inadequate.

In some cases, however, physiological acarbonization has

¹ *Journal of the American Medical Association*, May 3, 1902, referred to by *Lancet*, June 21, 1902.

never been reinforced by pathological acarbonization, at any rate to an efficient degree : pathological acarbonization has been absent from the outset, because, presumably, the organism has lacked the capacity to initiate or to complete such complex conservative processes. Here the intermediate period of efficient pathological acarbonization will be missing : adequate physiological acarbonization will pass directly into unrelieved hyperpyraemia : the clinical manifestations of unrelieved hyperpyraemia will often be the first indication of unphysiological action ; and they may appear at a comparatively early period.

In both classes of case referred to, the ensuing degeneration will depend, in the main, upon the condition of unrelieved hyperpyraemia, though doubtless, in the first, the nature of the degeneration will depend largely upon the nature of the antecedent pathological acarbonization. But even in the second class the hyperpyraemia will act indirectly, as well as directly : while the humoral condition will continue as a factor of malnutrition, the mechanical stress implied in one of its manifestations, namely, persistent high blood-pressure, will be, as I shall argue presently (§ 874), a most important, if not the most important, factor in the various degenerations of the circulatory system which so frequently follow. And so we shall have a complex combination of factors which will be, for the most part, inextricable : in the pathology of degeneration, we shall find it impossible, as a rule, to draw any sharp line of demarcation between the respective parts played by conservative pathological action, and by the absence or inadequacy of conservative pathological action.

ARTERIAL DEGENERATION

§ 869. The chronic affections of the arterial system, termed arterio-sclerosis and arterio-capillary fibrosis, and some, at least, of those described as atheroma, have been regarded from several different points of view. They have been regarded as inflammatory in nature, as purely degenerative, and, finally, as conservative or reparative in the first instance, and only ultimately as degenerative. It is the last of these views that is strongly supported by a comprehensive study of the effects of hyperpyraemia and hyperpyraemic affections on the vascular system.

Neglecting small differences of detail, similar conservative views of arterio-sclerosis are held by Thoma and by Jores of Bonn. The latter has shown that in some cases there may be 'an increase of the individual cellular elements of the internal coat and multiplication of the lamellae of the elastic layer, while even the longitudinal muscle fibres lying in close relation to the elastic layer may be hypertrophied';¹ in others, a regenerative connective tissue growth; and in others again, a combination of these conditions. He concludes that these changes are 'due merely to exaggeration of a reaction which is demonstrable in quite early life, on the part of the intima and other arterial coats, in response to a call for increased power of resistance against enhanced blood-pressure. Should such demands be excessive, then arterio-sclerosis, and if still further developed, fatty degeneration, takes place in the tissue that has been thrown up as a defence.'²

Jores's view has been criticized adversely in the 'British Medical Journal'³ on the ground that no explanation as to the cause of arterio-sclerosis can be considered adequate which neglects to include Martin's well-known views as to the influence of occlusive changes in the vasa-vasorum upon the nutrition of the vessel walls. But I cannot see that a conservative view, which freely admits the occurrence of ultimate degeneration in the newly formed tissue, is necessarily inconsistent with Martin's views. On the contrary, the former seems to leave ample room for the latter. For it may well be that the primary reparative growth of tissue leads in some way to the occlusive changes in the vasa-vasorum, and that these occlusive changes are amongst the proximate factors of the ultimate degeneration, fatty or other. Professor Thayer and Dr. Brush take an analogous view—a view, that is to say, which includes both a reparative and a degenerative element in arterio-sclerosis. Having shown from a lengthy study of 4,000 pertinent cases in the wards and at the clinic of Professor Osler that rheumatic, typhoid, and malarial fevers are in descending order of potency factors in arterio-sclerosis, these investigators say:⁴—'It seems to us that the main etiological factor in the development of the thickening (of the intima) in

¹ *Brit. Med. Journal*, September 17, 1904, p. 691.

² *Ib.*

³ *Ib.*

⁴ *Lancet*, October 8 1904, p. 1032.

arterio-sclerosis is the overstrain of the vascular walls from continued and intermittent high tension whatever its cause. . . . It is not inconceivable that the *rôle* of the acute infections may be rather in the production of those focal degenerations which constitute the other important element in arterio-sclerosis.' It may be, however, that the acute infections lead to overstrain through post-pyrexial hyperpyraemia and high blood-pressure.

The minutely careful investigations of recent workers have done much in the way of differentiation: they have shown that chronic arterial disease presents manifold variations in its clinical and pathological aspects; and the tendency has been to infer that under the terms 'arterio-sclerosis' and 'atheroma' have been included numerous morbid conditions owning numerous different pathological factors. Now we may, I think, go even farther than this in the way of differentiation: we may admit that every individual case of arterio-sclerosis or atheroma owns some pathological factor, or combination of factors, peculiar to itself. But that admission will in no way preclude us from holding the view that many, if not most, of the cases included under these terms, own some fundamental factors in common. Now it is with these common fundamental factors that we are mainly concerned, since it is to them that the theory of hyperpyraemia unhesitatingly points.

The common fundamental factors of arterial degeneration seem to fall naturally under two heads: (1) the humoral factor, an improper condition of the blood; and (2) the mechanical factor, intra-vascular strain.

§ 870. THE HUMORAL FACTOR.—This is commonly regarded as a toxæmia; and the poisons engendered in syphilis, malaria, etc., have possibly much direct influence in causing the arterial degeneration which so often affects those subject to these specific influences. But I have had frequent occasion to substitute hyperpyraemia for toxæmia; and the substitution in the present instance does not seem fraught with any special difficulty. For there is much evidence to show that hyperpyraemia is a common antecedent and concomitant of arterial degeneration.

Arterio-sclerosis owns a community of causation with obesity. Hyperpyraemia, we have seen, is essentially due to a carbonaceous income which is excessive relatively to the capacity of the organism for physiological acarbonization; and

obesity represents the straining of one form of physiological decarbonization. Conformably, Strumpfell¹ regards general arterio-sclerosis as 'chief amongst the morbid conditions which are referable to the same causes as obesity'; and Clifford Allbutt believes² that repletion, relative or positive, is the cause of the majority of cases. Hence arterio-sclerosis and obesity may concur. But it is obvious that the carbonaceous income will be more likely to be relatively excessive, other things equal, in persons who lack the capacity to become obese. Hence we shall expect arterio-sclerosis to affect at an earlier period and more severely persons of a lean habit. That it does so is at least my own experience; and this observation has been made by others, although I have lost the reference thereto.

Over-feeding is, of course, one of the commonest causes of hyperpyraemia; and Professor Stengel says:³—'I have seen many cases of advanced arterio-sclerosis in persons who have lived the most correct lives in every respect except over-feeding.'

Another common cause of hyperpyraemia, I have argued, is the prolonged exaggerated disintegration of the acarbonizing nitrogenous tissues which occurs in many pyrexias; and, as just pointed out (§ 869), Thayer and Brush have shown that some of the specific infections are potent factors in arterio-sclerosis.

§ 871. If arterial disease depends upon hyperpyraemia, we shall expect to find in the life-histories of some of those who present the signs of arterial degeneration evidence that the organism has attempted in various ways and at various periods to battle with hyperpyraemia. This expectation is amply fulfilled: it is certain that pathological acarbonizing processes depending on hyperpyraemia are common in such life-histories. Strumpfell⁴ remarks:—'The patient may . . . have certain functional nervous troubles like neuralgia or migraine. The direct cause of these is seldom evident.' And if we make full allowance for the conservative acarbonizing influence of migraine, we shall not be surprised to learn that the sudden cessation of this recurrent 'neurosis' is apt to be succeeded by the last and most serious result of arterial disease, namely,

¹ *Text-book of Medicine*, p. 938.

² *Lancet*, February 20, 1904, p. 507.

³ Quoted by the *Lancet*, January 30, 1904 p. 316.

⁴ *Text-book of Medicine*, p. 938.

rupture of the degenerated vessel-walls. Conformably, Liveing says :¹—‘ Sometimes the premature and abrupt cessation of an habitual megrim is among the earliest indications of commencing degeneration . . . of the vascular structures, and so may be the forerunner of apoplectic or paralytic seizures.’ In the case of a personal friend of mine, an almost lifelong migraine ceased suddenly at the age of 48, upon which he naturally congratulated himself ; but *twelve months later*, cerebral haemorrhage occurred during the night and proved fatal within a few hours.

Pathological acarbonizing processes other than migraine, but like migraine depending on hyperpyraemia, are common in the histories of those who are affected with arterial disease. Many such persons have suffered from *acute gout*, and then the succeeding arterial disease is apt to be regarded as a special variety and due to the gout. But acute gout is an acarbonizing process, and therefore we must regard the arterial disease as having arisen in spite, not in consequence, of the recurrent arthritis. Others have suffered, and may be continuing to suffer, from asthma ; and this vaso-motor affection must be placed in the same relation to the arterial disease as gout, namely, as depending on the common cause, hyperpyraemia.

§ 872. The frequent association of arterio-sclerosis with glycosuria is consistent with the view that both these affections may depend upon hyperpyraemia, or upon the causes or results of hyperpyraemia ; and that the latter is an acarbonizing process. Conformably, ‘ Grube of Neuenahr found arterio-sclerosis present in sixty-three out of 137 male patients ’ (suffering from diabetes), ‘ and in three out of forty female patients. But the majority of his patients were over the age of 45, and most of them suffered from the milder forms of the disease ’² (Williamson). It has been argued (§ 741) that in such cases persistent high arterial tension is often long antecedent to the glycosuria, and may persist after the glycosuria has been dispersed ; and persistent high arterial tension is a conspicuous clinical factor of arterio-sclerosis. Further than this, it has been noted in some cases, that the sclerotic condition of the arteries has been of much longer standing than the glycosuria. Williamson³ made a post-mortem examination upon a case in

¹ *Megrism and Sick-headache*, 1873, p. 26.

² *Diabetes Mellitus*, R. T. Williamson, 1898, p. 156.

³ *Ib.* p. 157.

which there was very extensive atheroma : ‘ definite symptoms of diabetes had been present during the last eleven months of life only, whilst the arterial changes were evidently of much longer standing.’ Many circumstances point to an antecedent hyperpyraemia as the cause of the arterio-sclerosis ; ‘ Frerichs¹ drew attention to the frequency of arterial changes in chronic forms of diabetes, especially when associated with gout’ (Williamson). Fleiner² takes a peculiar view : he ‘ thinks that a great number of the milder forms of diabetes, in elderly persons, are probably indirectly due to arterio-sclerosis’ (Williamson) ; and that in some, the proximate factor is disease of the arteries supplying the pancreas. This may be true of some cases : at any rate, disproof would be difficult. But even so, it is open for us to regard the glycosuria as a late attempt to disperse hyperpyraemia, the original factor of the arterio-sclerosis. Conformable with this conception is the fact, already referred to (§ 741), that in the severe diabetes of the young, the pulse tension is low : such cases are of course largely shielded from arterio-sclerotic changes. This is confirmed by Duckworth, who says :³—‘ It is certain that vascular degeneration is not common in diabetes of the gravest character, and when it is met with, it occurs in cases . . . where the arthritic element prevails and leads to this particular change.’

It might be argued that women during the reproductive period, though they are especially prone to suffer from a tendency to recurrent hyperpyraemia at monthly intervals, are, through the haemorrhagic acarbonization of menstruation, more protected than men against prolonged hyperpyraemia ; but that the cessation of menstruation at the climacteric equalizes both disparities, and leaves the sexes on a common level. This would explain an observation of Mott, who says :⁴—‘ Arterio-sclerosis is much more common in men under fifty, than in women ; but after the climacteric period, it is as common in women as in men ; if not commoner.’

§ 873. As we should expect, the manifestations of *unrelieved hyperpyraemia* are amongst the commonest antecedents and associates of arterial disease. During the recurrence of acute gout, vascular disease is to a large extent warded off ; but

¹ *Diabetes Mellitus*, R. T. Williamson, 1898, p. 157.

² *Ib.*

³ *Treatise on Gout*, 1890, p. 190.

Clifford Allbutt’s *System of Medicine*, vol. v. p. 321.

chronic gout—the gout which has ceased to be an efficient acarbonizing process,—and ‘*abarticulär*’ *gout*—that multitudinous group of symptoms which have been ascribed to unrelieved hyperpyraemia,—are notoriously associated with vascular degeneration. Dr. T. B. Futcher¹ found in thirty-three cases of chronic gout treated in the Johns Hopkins Hospital twenty-three cases of arterio-sclerosis. *Persistent high blood-pressure*, here ascribed to unrelieved hyperpyraemia, is the commonest antecedent and associate of arterial disease. *Plumbism*, I have argued, is capable of leading to hyperpyraemia: we have seen it associated with many of the manifestations of hyperpyraemia, such as recurrent bilious attacks, epileptiform convulsions, gout, high blood-pressure; and Osler says:²—‘Lead workers are notoriously subject to arterio-sclerosis. . . . The cases usually show distinct gouty deposits, particularly in the big-toe joint; but in this country’ (America) ‘gout in lead workers is rare.’ This observation seems to me of great value, since it enables us to dissociate arterial disease from true articular gout. In accordance with the theory of hyperpyraemia, it may be interpreted as follows: Lead poisoning is apt to lead, the world over, to hyperpyraemia and to its immediate and remote results, high blood-pressure and arterial degeneration; but it is mainly in England, the home of true gout, that the hyperpyraemia so induced is apt to be modified by the pyrexial acarbonization which follows the deposition of uric acid in the joints.

Amongst the other manifestations of unrelieved hyperpyraemia which are commonly associated with arterial degeneration may be mentioned angina pectoris and chronic renal degeneration. That many of the symptoms commonly seen in conjunction with arterio-sclerosis depend upon the associated conditions of hyperpyraemia and persistent high blood-pressure, and not upon the structural alterations in the vascular system, seems to be assured by the frequency with which they may be dispersed by hygienic and dietetic treatment, adapted to promote acarbonization of the blood. I have seen very persistent headache, neuralgia, bronchial catarrh and asthma, anginal symptoms, and many more, markedly relieved

¹ *New York Medical Journal*, 1902, July 5, p. 36.
Text-book of Medicine, Osler, 1894, p. 1010.

or dispersed in this way, even when associated with advanced arterio-sclerotic changes.

I shall argue presently that the influence of hyperpyraemia in conducting to arterial degeneration is, for the most part, restricted to its influence in causing intra-vascular strain through exaggerated or disordered vaso-motor action. Nevertheless, it may be that the overburdened condition of the blood, or the chemical perversion which may ultimately succeed to the overburdened condition, exerts a directly noxious influence upon the nutrition of the vascular walls. At any rate, we are not at present justified in excluding such direct action.

§ 874. THE MECHANICAL FACTOR.—The mechanical factor of intra-vascular strain is very generally recognised in arterial disease ; but it must, I think, be regarded for the most part as secondary to, that is, dependent upon, the humoral factor. Hyperpyraemia may conduce to strain in several ways. When prolonged and unrelieved, or inadequately relieved, by pathological acarbonizing processes, it may lead to general high blood-pressure, thus causing strain in the whole arterial system behind the peripheral constriction. And Professor Stengel finds elevation of blood-pressure an invariable symptom in the early stages of arterio-sclerosis. He says :¹—‘ It is detected by the finger on the pulse, or by the use of the manometer of Riva-Rocci or Von Basch. Auscultatory prolongation of the first heart-sound and a sharp accentuation of the second or aortic sound are present.’

Although, in general high blood-pressure, the intra-vascular strain affects the whole cardio-arterial system behind the peripheral obstruction, yet such strain is not uniform for the different parts of the system. Conformably, atheromatous degeneration is found almost exclusively in the left side of the heart where strain is greater : it is peculiarly prone to affect those situations, such as the greater curvature of the aortic arch and the valvular structures of the heart, where, muscular tissue being in small amount or absent, strain is but little moderated ; and it is common at arterial bifurcations and reflexions (Clifford Allbutt). Again, mitral stenosis leads to atheroma of the pulmonary artery, sometimes up to its

¹ Quoted by the *Lancet*, January 30, 1904, p. 317.

minutest subdivisions ;¹ and ‘occupations involving continuous muscular exertion tend to degeneration of the large arteries : navvies, blacksmiths, porters, labourers, soldiers, are often the subjects of this disease in early life’ (Mott).²

Clifford Allbutt is dubious as to the part played by muscular labour. He says of atheroma :³—‘Although well-marked, no doubt, on the greater curvature of the arch where tensile strain is highest, and at bifurcations and reflexions, yet it does not by any means confine itself to the parts which receive the main stress of muscular exercise, or to parts where, elastic tissue being most abundant, tone is least and tension most. On the contrary, it is one of the surprises of practice to find it in all sorts of odd areas ; and within such areas it is patchy.’ Nevertheless, it is, I think, possible to maintain the truth of the view that tension or intra-vascular strain, whether dependent on muscular exertion or other causes, is a most important factor in arterial disease. The unexplained addition of irregular and patchy areas of arterial disease points to the operation of some additional factor of intra-vascular strain ; and we may seek such additional factor in the frequency and widely varying localization of vaso-dilation.

If vascular tone is protective against intra-vascular strain, then any prolonged or frequently repeated vaso-dilation, which must be regarded as an inhibition of vascular tone, would, in the presence of vaso-constriction in other areas or of general high blood-pressure, conduce to strain, and thereby presumably to disease, in the dilated vessels. The proximate cause of the vaso-dilation would hardly be material. The vessel wall would suffer strain whether the vaso-dilation were passive, as in paretic conditions of the vaso-constrictor apparatus, or active, as in exaggerated action of the vaso-dilator apparatus : whether the vaso-dilation were an integral part of a complex neurosyal paroxysm (much evidence has been adduced showing the frequency and ubiquity of vaso-dilation so occurring), or merely accompanies severe or prolonged physiological function (the vaso-dilation which affects the muscular layer during physical exercise, is an example).

¹ J. H. Bryant, *Guy's Hospital Reports*, quoted in *Text-book of Medicine*, Pepper, 1894, vol. ii. p. 404.

² F. W. Mott in Clifford Allbutt's *System of Medicine*, vol. vi. p. 321,

³ *System of Medicine*, vol. v. pp. 910, 911.

§ 875. The power of vaso-dilation, whether physiological or pathological, to conduce to arterial disease may be inferred from numerous observations, most of which are clinical and pathological, a few experimental.

The frequency of atheroma in the anterior tibial artery has very often been noted. Now one of the commonest causes of hyperpyraemia, we have seen, is deficient physical exercise and this cause becomes increasingly frequent as age advances. But elderly persons whose exercise may be quite inadequate for physiological decarbonization continue to take some exercise; and slow walking is probably, in most instances, the last form of exercise to be abandoned. Now in slow walking, more especially in the shuffling gait of the very old, it is the anterior, rather than the posterior, muscles of the leg which tend to be mainly used: hence vaso-dilation and intra-vascular strain would affect mainly the chief supplying artery of the anterior muscles, namely, the anterior tibial.

In many cases of angina pectoris associated with organic changes in the heart, or 'true angina pectoris' as it is called, there may be, equally with the 'functional' form, palpable vaso-constriction of the peripheral arterioles; and there seems no valid reason for assuming that in such cases the graver differs essentially in its mechanism from the milder affection. Speaking of the structural cardiac lesions, especially the atherosomatous obliterative conditions of the coronary arteries so often found in fatal cases of angina, Fagge says:¹—'The long duration of the disease in some cases seems inconsistent with the idea that any of the organic lesions above described can have existed throughout its whole course. Possibly the paroxysms of angina owe to the lesions in question their severity and their tendency to prove fatal, but do not stand to them in the direct relation of effect to cause. For if the disease be regarded as a struggle on the part of the heart to overcome an excessive resistance in the arteries, enfeeblement of the cardiac muscle, whether as a result of fatty change or of a mere deficiency of blood-supply, cannot but add greatly to the embarrassment of the heart and the danger of the patient.' This conception is entirely consistent with the view here taken. But we may, I think, go farther and suppose, not only that the anginal paroxysms are independent of the organic lesions, but

¹ *Text-book of Medicine*, 1891, vol. ii. p. 23.

that both the functional disorder and the organic lesions depend upon common factors, namely, hyperpyraemia and strain on the part of the heart, whether this strain has manifested itself conspicuously in recurrent anginal seizures throughout, or has been, on the other hand, more or less continuous and concealed. So we might account at once for cases in which the so-called functional or pseudo-angina graduates into the so-called organic or true angina, and for cases which commence as the latter—for cases, that is to say, in which anginal seizures arise only after irreparable damage to the heart has been inflicted.

In any case, peripheral vaso-constriction would greatly increase the work of the heart: increased work would involve increased blood-supply; and increased blood-supply would necessitate increased dilation of the coronary arteries. So there would arise an increased degree of intra-vascular strain affecting these vessels, and consequently, a demand for increased resisting power. And such demand would be supplied by a fibrous hyperplasia of the intima and other tunics, 'which, if in a measure protective at its outset, passes in many cases into a destructive phase, leaving in its train impediment to the circulation' (Alexander Morison).¹

That anginal paroxysms are capable of seriously injuring the heart may be observed clinically. I have already quoted Broadbent to the effect that a single anginal paroxysm, arising during an ague paroxysm, may leave behind it for a time serious weakness of the heart (§ 413). And I have under observation at present a case in which anginal paroxysms, which could not conceivably have depended in the first place upon organic cardiac lesion, are now to all appearance causing progressive injury to the organ.

§ 876. The view that in the graver, not less than in the milder, variety of angina, the paroxysm depends proximately upon a pathological degree of coronary vaso-dilation, receives, it seems to me, important support from Alexander Morison's discovery of an intra-vascular aneurism affecting the right coronary artery of a man who died from the disease. The aneurism was small but fully developed: it had distended the intima, and was lying in contact with, and pressing upon, the

¹ Alexander Morison, *Lancet*, 1902, November 8, p. 1249.

We find such an aneurism, 'freely communicating with the lumen of the vessel, pulsating with every throb of the heart, and recording on the muscular coat of the artery variations in arterial pressure, should explain, at least in some cases, why one person may have calcareous arteries without angina, and why another with apparently the same condition of these vessels should know all the agony of breast-pang.' Now it could not be contended that the distension of such an aneurism would be increased by vaso-constriction or claudication of the artery from which it springs: it is, on the contrary, certain that the distension, and therefore the pressure exerted by the distension, would vary inversely with the degree of constriction, directly with the degree of dilation, of the coronary arterial trunk. Moreover, it is reasonable to suppose that the formation of such an aneurism would be favoured by exaggerated vaso-dilation and the inhibition of muscular support so entailed.

§ 877. Many further observations support the view that vaso-dilation is an important factor in arterio-sclerosis. It has been argued that in both migraine and some cases of neuralgia vaso-dilation of some artery, or arteries, is the proximate cause of the pain. Conformably, Gowers and Barlow may be quoted. The former says:¹—'In a woman, aged 50, liable to right-sided migraine from youth, the right temporal artery was harder and more rigid than the left.' The latter says:²—'In a case of severe left-sided supra-orbital neuralgia, Thoma found the left temporal artery in a far more advanced state of sclerosis than the corresponding artery on the other side: he ascribed this to alteration of the arterial walls, brought about by the accompanying vaso-motor disturbance.' Barlow also states³ that 'there is . . . some evidence that arterio-sclerosis can be brought about by section of nerve-trunks (Fraenkel and others)': such would cause more or less protracted vaso-dilation.

In renal cirrhosis, a disease almost always associated with high blood-pressure, there is commonly more or less increased diuresis. Such implies more or less prolonged vaso-dilation of

¹ *Lancet*, November 8, 1902, p. 1248.

² *Dis. Nerv. System*, 1893, vol. ii. p. 848.

³ Clifford Allbutt's *System of Medicine*, vol. vi. p. 617.

⁴ *Ib.*

the renal arterioles with intra-vascular strain therein sions strain depends upon, or perhaps is merely increased by, and general high blood-pressure, which in turn depends upon the combined influence of widespread vaso-constriction and increased action on the part of the hypertrophied left ventricle. Conformably, it is found that the renal arterioles are invariably affected by arterio-sclerosis.

In all the foregoing examples, we are supposing that frequently repeated or protracted vaso-dilation determines the occurrence of hyperplastic changes through creating a demand for increased resisting power on the part of the vessel walls. Such demand would be created through the inhibition, partial or complete of the vascular tone and the resulting loss of muscular support. Now in these circumstances we should expect to find the intima—the tunic which is called upon to bear so much of the increased strain—markedly hyperplastic; but we should, on the other hand, look for some atrophy of the muscular tunic, through simple disuse and perhaps also through stretching.

§ 878. These changes have been demonstrated microscopically, at any rate in the case of the renal arterioles in cirrhosis of the kidney. William Russell,¹ from an examination of sixteen cases, concludes that in the arteries within the kidney, 'the media is not appreciably thickened, it may even be atrophied and may have undergone hyaline degeneration': the intima, on the other hand, he finds to be greatly thickened. Russell, however, finds that 'the lumen of the arteries in the kidneys is markedly diminished.'² On the other hand, Thoma's 'measurements . . . demonstrate that the arterioles of the kidney are absolutely dilated in spite of the increased thickness of the walls' (Saundby).³ Clearly, the latter is what we should have anticipated from the views here entertained, yet the discrepancies between Russell's and Thoma's results are not necessarily irreconcilable. For it may be, in some cases, that the intimal hyperplasia, once started, proceeds beyond the needs of the vessel and thus, by diminishing the lumen, largely defeats the conservative purpose of the vaso-dilation: similar lack of accurate adaptation is common in all conservative pathological processes (compare §§ 921 to 924).

¹ *Lancet*, June 1, 1901, p. 1520.

² *Ib.*

³ *Renal and Urinary Diseases*, Saundby, 1896, p. 48.

We may now, I think, reasonably conclude that the wide distribution of arterial disease, its frequent patchy character, and its localization in unexpected situations, as pointed out by Clifford Allbutt (§ 874), are all explicable in great part by the frequency and widely varying localization of vaso-dilation, and the numerous consequent exaggerations of localized intra-vascular strain.

§ 879. It cannot be maintained, however, that abnormal vaso-dilation always precedes arterial disease. In general high blood-pressure, intra-vascular strain would be present in the whole arterial system behind the peripheral obstruction: it would affect those arterial areas which are frequently or habitually constricted, as well as those which are dilated. But in the former, it would be reasonable to expect the strain to be less severe, and the compensatory hypertrophic changes to be differently distributed as regards the various coats. Frequently recurring, or habitual, vaso-constriction would tend to cause hypertrophy of the muscular coat; but, conformably with the general rule that morbidly hypertrophied structures tend to early degeneration, we should not expect such myo-hypertrophy to endure over-long in a pure state. Further, we should expect some hypertrophy of the intima in accordance with the exaggerated general intra-vascular strain due to the general high blood-pressure which is so frequently present in these cases.

These expectations seem to me fully borne out on an appeal to microscopic demonstration. The radial is the accessible artery which is perhaps the most frequently and habitually constricted, whether in the tendency to recurrent high blood-pressure of the paroxysmal neuroses, or in the well-known condition of persistent high blood-pressure of middle or advanced life; and the radial is the artery upon which the most accurate clinical observations have been made. William Russell says: ¹—‘In a case with renal symptoms, the condition of the radial artery forms a large part of the foundation warranting a diagnosis of kidney change. The vessel is indurated and its wall is thickened: the induration is uniform, and the vessel, as felt upwards along its course, has been compared to whip-cord or other substances. The truest comparison is to be found in the difference which, to any educated finger,

¹ *Lancet*, June 1, 1901, p. 1520.

exists between a thin-walled and a thick-walled piece of rubber tubing of the size of an average radial artery. The uniformity of this thickening distinguishes the condition from atheroma, where the thickening is irregular.'

This description of the radial artery is completely consistent with muscular hypertrophy of the media, due to frequently recurring, or more or less prolonged, vaso-constriction. The condition usually coexists with high blood-pressure because continuous vaso-constriction is an essential factor in high blood-pressure; but the association is not a necessary one. The vaso-constriction which is the cause of the muscular hypertrophy may fail to establish high blood-pressure, through some of the compensatory circulatory changes already considered; or it may have succeeded in establishing a high blood-pressure which has disappeared or become dispersed: in either case, the thickening of the vessel from muscular hypertrophy would probably remain more or less permanently.

Broadbent points out that the hypertrophy of the muscular coat was long ago demonstrated by George Johnson, and says:¹ 'A certain degree of fibroid change is, no doubt, present together with the hypertrophy of the muscular fibres, and late in the disease the muscular fibres undergo more or less degeneration, allowing the fibrosis to predominate; but this, in my judgment, is all that subsequent investigations have established.' Quite recently, this has been confirmed by William Russell,² who thus contrasts the microscopic appearances presented by arteries inside the kidney, and by arteries outside the kidney as exemplified by the radial:—'Inside the kidney, the changes are most marked in the intima: outside it, the changes are most marked in the media. In both, however, the intima is thickened. Inside the kidney, the media may disappear and it often atrophies: outside the kidney, this never occurs.'

§ 880. THE CONSERVATIVE VIEW OF ARTERIAL DISEASE.— It seems clear that both the hypertrophies of the vascular coats described—that of the muscular middle coat in arteries mainly subject to vaso-constriction, and that of the fibrous inner coat in arteries mainly subject to vaso-dilation—must be regarded as strictly conservative, in that they are both adapted to the altered conditions and requirements of the arteries. And the subsequent somewhat early degeneration of the additional

¹ *The Pulse*, 1890, p. 237.

² *Lancet*, June 1, 1901, p. 1520.

tissue need not preclude us from holding this view, since early degeneration seems to be the fate of most tissue which is newly formed in adult life.

But the conservative view of arterial disease has been carried much further than this: it has been considered in connexion with one of the latest results of arterial degeneration, namely, rupture and extravasation of blood. If in sufficient amount, haemorrhage of any kind tends, as already argued, to reduce blood-pressure, the condition upon which it largely depends; and this is true, whether the blood escapes externally, or into most tissues. But extravasation of blood into the brain would seem to attain the same end more permanently by another route, without special regard to the quantity extravasated. Oliver says:¹—‘In connexion with the relief of excessive blood-pressure which arises from the widening of the peripheral arteries, it is, I think, clinically interesting to find that when cerebral haemorrhage, producing hemiplegia, takes place in a subject presenting high maximum pulse-pressure, the radial artery on the paralysed side becomes considerably increased in calibre, and the blood-pressure falls on both sides; so that it would seem that the haemorrhage, inducing at once an enlargement of the calibre of the arteries over half the body, relieves the general blood-pressure, and thus limits the disposition to further extravasation.’

It is, I believe, held that hemiplegia, in some cases, prolongs life (Broadbent), and the above would be an adequate explanation. A permanent reduction in blood-pressure, such as that just described, would explain also the following case related by D. Brunet:²—‘A woman born in 1812 . . . an inmate of La Charité since March 1857. She was epileptic since the age of 7 years, the first convulsive attack following scarlet fever. The attacks took place every month or fortnight. . . . In 1857 she had an attack of incomplete left hemiplegia, following violent convulsive attacks. Thereafter, the fits which she used to suffer from gradually diminished in severity, and in 1860 she was entirely free from fits. There was complete freedom from fits for seventeen years till her death in 1877 . . . it is believed that cerebral haemorrhage was the immediate cause of the attack of hemiplegia.’ A condition of permanent vaso-dilation, even on one side of the body, would permanently impair the

¹ *Pulse-gauging*, 1895, p. 147.

² *Archiv. de Neurol.* March 1900.

mechanism of an epileptic convulsion, if this mechanism is such as has been argued in Chapter XI.

§ 881. ARTERIAL DISEASE A PREMATURE PHYSIOLOGICAL DEGENERATION.—I have argued (1) that in physiology the vaso-motor system regulates, by means of variations in the calibre of arteries, the supply of fuel to the acarbonizing mechanisms ; and that the physiological tone of the arteries is largely dependent on a certain normal mean in the carbon contents of the blood (§ 753) ; (2) that pathologically exaggerated vaso-constriction, or hypertonus, may be due to abnormally high carbon contents or hyperpyraemia, and may, in the absence or inadequacy of compensation, result in persistent high blood-pressure ; and (3) that hyperpyraemia may lead perhaps directly in virtue of its being a perverted humoral condition, but at any rate indirectly or mechanically through hypertonus and consequent strain, to arterial degeneration.

Hence it is obvious that these influences which conduce to premature arterial degeneration are merely exaggerations of the physiological influences which probably would in any case lead eventually to arterial degeneration. Pathological arterial degeneration would thus be premature physiological arterial degeneration : as has long been recognised clinically, ‘a man is as old as his arteries.’

A similar argument might be applied in connexion with the cardiac degenerations, to be next considered.

CARDIAC DEGENERATIONS

§ 882. Associated with the arterial changes described are various cardiac affections, for the most part primarily compensatory, though ultimately degenerative, in nature. In considering these, it is even more difficult than in the case of the arterial affections to discriminate between the respective parts played by the humoral and mechanical factors : the latter is the more conspicuous, but we cannot exclude the former.

ENLARGEMENT.—Enlargement of the heart, mainly, but in some cases purely, hypertrophic, is probably almost wholly conservative and due to the increased peripheral resistance introduced into the circulation by hyperpyraemic conditions. This increased peripheral resistance must be regarded as due mainly to continuous vaso-constriction, but the subsequent

arterio-sclerosis, implying as it does a material loss of elasticity, must not be left out of account.

Broadbent says :¹—‘ Dilatation is another common result, either preceding hypertrophy, or associated with it from the beginning, or supervening at a later period. It is usually gradual in its development, but acute dilatation of the heart is a more common occurrence than is generally supposed, and when it is induced by effort, antecedent high arterial tension is, according to my experience, a constant predisposing factor. The left ventricle is unable to overcome the obstruction in the peripheral circulation, and gives way under the strain.’

In the following case, described by William Russell,² the symptoms were obviously, to a large extent, due to a state of continuous vaso-constriction of the systemic arterioles and to a propulsive power on the part of the left ventricle which was inadequate to overcome the exalted peripheral resistance introduced into the circulation. A man of 60, ‘ suffering from extreme orthopnoea, believed to be of cardiac origin and due to myocardial degeneration. The vessels were thickened, but they also seemed . . . to be in a condition of hypertonus. He got great relief from the administration of antispasmodics. The arteriometer measurements were respectively 2·4 and 2·7 millimètres.’

Mitchell Bruce³ made a careful study of twenty-nine cases of disorder and disease of the heart and arteries in ‘ gouty ’ persons at or over middle age. ‘ Twelve of these (ten males and two females) had suffered from ordinary articular gout, the other seventeen (six males and eleven females) had irregular gout. . . . The average age was 62. In no instance was there albuminuria. The physical condition of the heart and arteries, and the patients’ complaints, were remarkably alike in the two groups. In twenty-three of the twenty-nine, the heart proved to be enlarged, either on one or on both sides. In less than half the number, the cardiac action was feeble ; in a small number the impulse was entirely imperceptible ; the heart and pulse rate were ordinary ; the rhythm was but seldom irregular.’

§ 883. VALVULAR AFFECTIONS.—The aortic degeneration which may follow prolonged high blood-pressure is commonly

¹ *The Pulse*, 1890, p. 168.

² *Lancet*, June 1, 1901, p. 1522.

³ ‘ Lettsomian Lectures,’ *Brit. Med. Journal*, March 23, 1901, p. 702.

associated with dilatation: this may extend 'to¹ the ostium, which becomes so stretched that the valves are not large enough to meet and close it. In this way arises one form of aortic incompetence or regurgitation, which comes on for the most part at or after middle age, and is distinguished from regurgitation, due to actual valvular disease, by the imperfect development of the collapsing pulse and of the carotid delay, and by the persistence of the accentuated aortic second sound which had preceded the appearance of the murmur. . . . Another secondary effect of aortic atheroma is narrowing of the orifices of the coronary arteries. This, with extension of atheromatous disease into these arteries from the aorta, is the most common cause of fatty degeneration of the heart, which must thus be set down as one of the consequences of high arterial tension' (Broadbent).

'Valvular² disease, properly speaking, is also set up by high arterial tension.' The persistent strain so induced 'gives³ rise to chronic valvulitis which results in thickening and contraction of the cusps, with incompetence or stenosis. A systolic murmur is frequently caused by roughening and rigidity or irregularity of the valves without actual obstruction, and the loudest cardiac murmurs ever heard are those so produced. As there is no interference with the mechanism of the heart, such murmurs have no importance, except that they show that changes have set in of a progressive character which, moreover, may possibly implicate the orifices of the coronary arteries' (Broadbent).

'The⁴ mitral valve suffers in like manner. . . . The consequence of mitral valvulitis thus induced is usually insufficiency—never, so far as my experience goes, stenosis, except, perhaps, to a slight degree when calcareous deposit has rendered the valves rigid and unyielding. Regurgitation through the mitral orifice may also result from dilatation of the ventricle, which may implicate the auriculo-ventricular opening, and make it so large that the flaps fail to occlude it' (Broadbent).

More or less conformably with the above, Mitchell Bruce⁵ found 'that in no fewer than twelve out of the twenty-nine cases of gouty heart, a systolic murmur was to be heard over the aortic area, the manubrium, and the right carotid, signi-

¹ *The Pulse*, Broadbent, 1890, pp. 166, 167.

² *Ib.* p. 167.

³ *Ib.*

⁴ *Ib.* pp. 167, 168.

⁵ 'Lettsomian Lectures,' *Brit. Med. Journal*, March 23, 1901, p. 702.

cant of disease, either of the aortic arch or of the aortic valves, in every instance independently of rheumatism or other obvious cause than gout.' He adds :¹—' In seven (25 per cent.) of my cases, a more or less developed systolic murmur was found in the mitral area, significant either of valvular atheroma and sclerosis, or of leakage from ventricular dilatation. Very curiously, I have never met with aortic incompetence of gouty origin.'

Entirely consistent with the view that arterial and cardiac degenerations frequently depend primarily upon prolonged hyperpyraemia, and secondarily upon the consequent disordered or exaggerated vaso-motor action, are the humoral view of W. Bezly Thorne and the mechanical view of Huchard. Thorne² states that among 'cases presenting impairment of health in which abnormal conditions of the heart and blood-vessels have played a leading part, fully 90 per cent. have exhibited collateral symptoms which point to serious and prolonged contamination of the blood-stream.'

M. Huchard divides all cases of organic cardiac disorder into two classes: (1) those in which the disturbance is primarily peripheral—the primarily arterial form of cardiac disease, occurring in about 60 per cent. of all cases; and (2) the so-called rheumatic, or primarily valvular, cardiac cases, occurring in about 40 per cent. of all cases. It is, of course, amongst the first, or larger, of the above two classes that the hyperpyraemic cases are to be included. In the development of this class, Dr. Paul Bergouignan, a pupil of Huchard's, recognizes three stages: (1) a pre-sclerotic stage: (2) a cardio-arterial stage; and (3) a cardio-mitral stage. As this author points out, 'the second and third stages are familiar to us all, for in the second stage we often meet with cardiac arrhythmia, primary angina pectoris gravis, and the Stokes-Adam's syndrome, all more or less associated with manifest disorder of the peripheral vessels: in the third stage, with a failing left heart and regurgitation through the mitral orifice, we see the familiar picture so often met with in hospital wards. The symptoms and signs, however, of the pre-sclerotic stage are rather ill-defined and not yet fully understood.'³ According to my

¹ 'Lettsomian Lectures,' *Brit. Med. Journal*, March 23, 1901, p. 702.

² *Observations on Cardio-vascular Repair*, W. Bezly Thorne, J. & A. Churchill, 1898, p. 12.

³ *Brit. Med. Journal*, January 9, 1904, Review on *Le Traitement rénal des Cardiopathies Artérielles*, par le Dr. Paul Bergouignan. Paris: Jules Rousset, 1902.

view, of course, this early stage consists of hyperpyraemia, which in accordance with the varying proclivities, or pathological capacities, of different individuals, may lead to pathological acarbonization of any kind, such as migraine, asthma, gout, or to any of the manifestations of unrelieved hyperpyraemia, such as persistent high blood-pressure with subsequent degeneration, vascular, cardiac, renal, or other.

There can be little doubt that hyperpyraemia constitutes a fundamental factor in many cases of chronic cardiac disease; and further, it seems certain that the continuance of hyperpyraemic conditions is often closely connected with the cardiac failure which ultimately supervenes. Professor J. Bauer says :¹ ‘The belief that persons with valvular and other diseases of the heart . . . should observe great moderation in food and drink has been confirmed by long experience.’ Douglas Powell refers to the case of a patient suffering from mitral stenosis ‘who, after the relief of urgent symptoms by rest and treatment, had gradually been fed up to the point of plethora, and who one morning, after a large breakfast, fell dead.’² I was myself connected with a similar case.

A stout elderly man suffering from mitral insufficiency had recovered from general anasarca under rest, low diet, and digitalis; but his relatives, insisting that he was being starved, themselves undertook the dietetic management of the case. A course of feeding up was followed by a return of the dropsy; and a meal consisting largely of plum-pudding was rapidly succeeded by cardiac failure, this time irreparable.

The diet most suitable, in my experience, for cases of heart disease with impending failure is a small proteid diet, to which are added just enough fats and carbohydrates to maintain nitrogenous equilibrium and prevent any material loss of weight: the purely carbonaceous addition is important, for a Salisbury diet in such cases is certainly injurious. In many cases in which cardiac failure had already commenced, and in which digitalis had failed, or had ceased to act, the above-defined dietetic restriction has been followed by a satisfactory re-establishment of the action of digitalis and by a prolongation of complete compensation, in some cases for years (Case LXXXIII).

¹ Von Ziemssen’s *Handbook of General Therapeutics*, 1885, vol. i. p. 248.

² *Lancet*, November 28, 1903, p. 1502

VENOUS DEGENERATION

§ 884. Sclerotic changes have been shown by Thoma to occur in the veins—phlebo-sclerosis: indeed, this investigator considers arterio-sclerosis and phlebo-sclerosis merely as parts of a morbid process affecting the whole vascular system—a process to which he applies the inclusive term, ‘angio-sclerosis.’¹

VARICOSE VEINS.—Phlebo-sclerosis becomes clinically prominent in the condition known as varicose veins. These are, for the most part, confined to the lower extremities: hence we may believe that the mechanical factor in phlebo-sclerosis consists largely of the force of gravity. But that hyperpyraemia is a humoral factor of considerable importance in many cases seems assured by the marked influence of acarbonizing treatment, dietetic and other (Case LXII); and Duckworth says² that varix is common in irregular gout.

W. Bezly Thorne³ calls attention to the frequent occurrence of distended cutaneous veinlets which ‘may be observed in children of any age from about one year upwards in parts where the skin is most delicate, as in the cheeks and supra-mammary part of the chest. They occur in those who are the subjects of persistent gastro-intestinal fermentation, whose stools during the first year of life have habitually emitted an acid odour and perhaps imparted a zone of green colouration to the cloth on which they are received. Such children are fractious, irritable, given to crying: their urine frequently deposits crystals of uric acid, and generally they display . . . many of the characteristics of the so-called gouty diathesis. . . . Such subjects are, moreover, especially prone to bronchial affections, not seldom complicated with asthma.’ It has been argued that many cases of gastro-intestinal fermentation are due to the absence of the digestive fluids from the alimentary canal, secondary to distension of the liver by glycogen and consequent mechanical congestion, or stasis, in the portal system (§ 452); that the gouty diathesis is synonymous with unrelieved hyperpyraemia; and that asthma and bronchial affections commonly depend upon hyperpyraemia and may be acarbonizing processes. Further, the admittedly successful dietetic manage-

¹ Mott in Clifford Allbutt’s *System of Medicine*, vol. vi. p. 320.

² *Treatise on Gout*, 1890, Duckworth, p. 276.

³ *Observations on Cardio-vascular Repair*, 1898, J. & A. Churchill, p. 9.

ment of the well-known gastro-intestinal disorder referred to, is rigidly acarbonizing, consisting as it does of a short abstention from food of all kinds, followed by a purely proteid diet, such as raw-beef juice or solution of white of egg, and later, by strict limitation of starches and sugar.

I see no adequate reason for drawing any fundamental distinctions, etiological or anatomical, between the juvenile distended veinlets above described and the distended veinlets which are so commonly seen in middle and advanced life upon the nose and adjoining areas of the cheeks, and which constitute the early stage of rosacea. The markedly beneficial influence of acarbonizing treatment upon these latter is elsewhere referred to (§ 834).

RENAL DEGENERATION

§ 885. If it is accepted that recurrent hyperpyraemia is the underlying blood-state in recurrent acarbonizing processes, such as migraine, asthma, and gout; and that continuous or unrelieved hyperpyraemia is responsible for the vascular condition of persistent high blood-pressure and leads ultimately, both directly and indirectly, to degenerative disease of the blood-vessels and heart:—then it will almost certainly follow, on clinical grounds alone, that renal degeneration, at least in some cases, is an associated result—that cirrhosis of the kidney stands at, or near, the termination of the long train of pathological processes already considered. And we may hold this view, while as yet we may be quite unable to explain the rationale, or pathological mechanism, of the renal degeneration.

§ 886. CLINICAL EVIDENCE OF HYPERPYRAEMIA, ANTECEDENT AND COEXISTENT.—It has often been argued that a well-developed fat-forming capacity is one of the most effective safeguards against hyperpyraemia. Hence, on the hyperpyraemic theory, we should expect to find renal cirrhosis more frequent in persons of a lean habit. Now Saundby says:¹ ‘I incline to the opinion that the spare neurotic type is especially prone to suffer from lithaemic kidney.’

The symptoms of the pre-albuminuric stage of chronic Bright’s disease are, according to Mahomed,² ‘cold hands and

¹ *Renal and Urinary Diseases*, 1896, p. 118.

² *Uric Acid in Disease*, Haig, 1897, p. 432.

feet, imperfect digestion, bronchitis, gastric catarrh, headache (especially hemicranial), loss of memory, depression, weariness, cloudiness of intellect, and hypochondriasis'; and many of these have been regarded as common manifestations of hyperpyraemia, of the associated subordinate glycogenic distension of the liver, or of the exaggerated vaso-motor action.

§ 887. The past histories of many cases of granular kidney disclose a prolonged struggle on the part of the organism against hyperpyraemia. Pathological acarbonizing processes, recurrent for many years, are often conspicuous in such. Bartels called attention to the frequent association of *migraine* with Bright's disease. Haig¹ has 'seen quite a large number of cases in which periodical sufferers from the uric-acid headache' (by which term he refers to migraine) 'have come to suffer from albuminuria and chronic Bright's disease.' My own experience is confirmatory. I know of three cases of nearly lifelong migraine who are now suffering from renal cirrhosis, persistent high blood-pressure, arterio-sclerosis, and cardiac hypertrophy; and in all of them the migraine must have been long antecedent to the organic changes. In these cases, the severity of the migraine paroxysms seems to have undergone marked exacerbation since the development of the renal degeneration. Exacerbation of migraine, in these circumstances, has been noted by Haig² and is several times insisted on in his work. This exacerbation is in marked contrast to what occurs when glycosuria supervenes in a case of migraine. Glycosuria, unlike Bright's disease, is, as already argued, a substitutive acarbonizing process: hence, as we have seen, glycosuria almost invariably terminates migraine paroxysms (§ 333).

The position occupied by migraine in the life-history of cases of renal cirrhosis may be taken apparently by any other pathological acarbonizing process. I have seen several cases in which recurrent asthma has long preceded the development of renal cirrhosis, with its associated vascular and cardiac changes; and in these the asthma has persisted, if it has not become aggravated. Tirard³ states that asthmatic attacks, in many cases indistinguishable from ordinary spasmodic asthma, are liable to come on during the small hours of the

¹ *Uric Acid in Disease*, Haig, 1897, p. 425.

² *Ib.* p. 436.

³ *Albuminuria and Bright's Disease*, 1899, p. 202.

morning in renal cirrhosis. James Mackenzie says: ¹—‘ Attacks of difficult breathing are found . . . in those suffering from chronic Bright’s disease, associated with periods of increased arterial pressure. These attacks may be so severe as to resemble asthma. . . . In others, the attacks are of the nature of bronchitis, accompanied by great breathlessness on exertion. In these, the pulse is usually small and hard.’ That the mechanism of ‘renal asthma’ is identical with the mechanism of asthma generally, seems assured by an observation of William Russell,² who measured the diameter of the radial artery by Oliver’s arteriometer, during and after a paroxysm : the measurements were 2·2 and 2·6 mm. respectively.

Dr. A. J. Turner tells me of a medical friend of his who used to suffer for many years from regularly recurrent *gastral-gia*, necessitating the use of morphia hypodermically. He succumbed eventually with all the signs of renal cirrhosis.

Attacks of *acute arthritic gout* are, of course, common in the life-histories of sufferers from renal cirrhosis. It is usually inferred that the gouty attacks are factors in the renal disease, which disease is then regarded as a special variety, namely, the gouty kidney. But since acute gout is an acarbonizing process, we must regard the kidney disease as arising in spite, rather than in consequence, of the articular paroxysms. Hence, as pointed out by Samuel West,³ ‘many persons have gout all their lives, and yet the kidneys are found healthy at the end.’ These are the cases in which the gout remains frankly pyrexial.

Similarly, we must regard the renal cirrhosis which supervenes in cases of migraine, asthma, and *gastral-gia*, as arising in spite, not in consequence, of these recurrent acarbonizing paroxysms. Such paroxysmal neuroses are, in all probability, physiologically prepotent and only partially efficient in promoting acarbonization. In accordance with this view, it is not surprising that many cases of renal cirrhosis occur, in which no antecedent pathological acarbonizing process is to be found. And such, I have often imagined, are apt to be unusually severe and of unusually early development.

Epileptic or, as they are more usually called, epileptiform

¹ *Study of the Pulse*, 1902, p. 73.

² *Lancet*, 1901, June 1, p. 1522.

³ *Practitioner*, July 1903, p. 37.

convulsions are common during the course of renal cirrhosis ; and they are especially prone to occur at such periods as hyperpyraemia is most liable to become exaggerated. Thus Roberts¹ refers to the case of a married woman, aged 39, who died ‘ comatose after repeated attacks of convulsions. Each cataamenial period was marked by great nervous excitement ; and on several occasions convulsions took place at these periods, accompanied with temporary amaurosis. Severe headache was a very constant symptom, *especially on the days preceding the catamenial periods.* After death the kidneys were found granular and atrophied.’ (Italics mine.) On the other hand, instances in which renal cirrhosis has supervened in old-standing cases of idiopathic epilepsy seem rare. This, I am inclined to think, is to be explained by the fact that major epilepsy, through its tendency to become rapidly prepotent and thus to be evoked by continually decreasing degrees of hyperpyraemia (compare § 749), is apt to remain a peculiarly efficient acarbonizing process.

§ 888. Many of the *manifestations of unrelieved hyperpyraemia* are amongst the commonest antecedents and associates of renal cirrhosis. Troussseau,² following Rayer, Bright, and others, regarded Bright’s disease as an expression of ‘ anomalous ’ gout : Murchison³ ascribed the ‘ contracted granular or gouty kidney ’ to lithaemia ; and Saundby⁴ terms renal cirrhosis ‘ lithaemic nephritis.’ The last-named author, as do most others, clearly regards lithaemia and the gouty diathesis as synonymous terms ; and I am regarding both terms as synonymous with hyperpyraemia, unrelieved or inadequately relieved.

Angina pectoris has been regarded as an attempt, more or less successful, at acarbonization, depending on hyperpyraemia and associated or not with circulatory degenerative changes. Conformably, Tirard⁵ states that angina pectoris is a frequent concomitant of renal cirrhosis. And James Mackenzie⁶ points out that those who suffer from Bright’s disease are liable to recurrent periods of increased arterial pressure, and that these

¹ *Renal and Urinary Diseases*, W. Roberts, 1885, pp. 455, 456.

² *Clinical Medicine*, New Syd. Soc., vol. iv. p. 381.

³ *Functional Derangements of the Liver*, 1874, p. 78.

⁴ *Renal and Urinary Diseases*, 1896, p. 117.

⁵ *Albuminuria and Bright’s Disease*, 1899, p. 202.

⁶ *The Study of the Pulse*, 1902, pp. 73, 74, 75.

may be associated with severe praecordial distress or sometimes with ‘attacks of angina pectoris of a most dangerous form.’ He says:—‘Treatment devoted to the lowering of the arterial pressure, as by the administration of a mercurial purge, or by the use of iodide of potassium, has often a speedy and beneficial effect.’ And in more than one fatal case of angina pectoris I have found well-marked renal cirrhosis, as well as atheromatous disease of the coronaries and aorta.

It has been argued that *chronic bronchitis* may be a manifestation of unrelieved hyperpyraemia (§ 774); and Saundby says:¹—‘Bronchitis accompanied by emphysema is found post mortem with some frequency’ in renal cirrhosis.

Chronic articular gout, we have seen, depends upon hyperpyraemia, but has ceased to be an efficient acarbonizing process: hence it is associated with chronic or unrelieved hyperpyraemia and chronic or unrelieved uricaemia. Consequently, it is in the chronic variety of articular gout that renal cirrhosis is most frequently found, as originally pointed out by Todd. Garrod² says that in all the cases of chronic chalk gout where he was afforded an opportunity of making a post-mortem examination, the kidneys were contracted and seldom weighed more than $3\frac{1}{4}$, sometimes as little as $2\frac{1}{2}$, ounces. He also found that in many cases deposits of urate of soda were conspicuous in the pyramids and, to a less extent, in the cortex; but he admits that this may be observed, though more rarely and in less degree, in subjects other than those who have had gout in their articulations. Dr. T. B. Futcher³ of Baltimore analyses thirty-six cases of gout which were treated in the Johns Hopkins Hospital. Thirty-three of the cases had reached the chronic stage. ‘There was evidence of disease of the kidneys in the majority of the cases. Albuminuria occurred in twenty-seven, and hyaline and granular casts in twenty-three, instances.’

§ 889. *Lead*, I have argued, may give rise to hyperpyraemia: we have seen it lead to pathological acarbonizing processes; and to many of the manifestations (vascular, nervous, psychical, and other) of unrelieved hyperpyraemia: it is known to be associated with chronic uricaemia; and to predispose to

¹ *Renal and Urinary Diseases*, 1896, p. 162.

² *Gout and Rheumatic Gout*, 1876, pp. 197, 198, 199.

³ *New York Medical Journal*, July 5, 1902, p. 36.

at least one variety of structural degeneration, namely, general arterio-sclerosis. Hence we are not surprised to find that 'next to gout, the best-known cause of cirrhosis of the kidneys is chronic poisoning by lead'¹ (Fagge).

§ 890. My own experience of the dietetic management of cases of renal cirrhosis points to the frequent continuance of hyperpyraemia in association with this affection. The antecedent affections and symptoms, just enumerated, do not cease with the development of the renal disease, though no doubt they sink somewhat in clinical importance with the onset of albuminuria; and I have often seen the majority of these persisting hyperpyraemic manifestations markedly relieved, or held in complete abeyance, by dietetic and hygienic treatment adapted to promote acarbonization of the blood. In the following two cases, the results were conspicuous:—

A lady of 63 showed all the typical signs of renal cirrhosis, including albuminuria, polyuria, high-tension pulse, and cardiac hypertrophy, with accentuation of the second sound. She suffered also from nearly constant headache, dyspepsia after almost every meal, great depression, weariness, and irritability, with inability to concentrate her attention. Her daily diet was cut down to 8 ounces of proteid, 3 of starch foods, and 1½ pint of milk: sugar was interdicted and she was ordered exercise in the open air, short of fatigue. On this, she rapidly improved. The albuminuria and polyuria continued unchanged; nor could I detect with the finger any material decrease of pulse-tension during the first year. But the headaches and dyspepsia ceased absolutely; and she became comparatively bright, energetic, and equable, and able once more to conduct her domestic affairs (Case LXXXIV).

A rather stout gentleman of 58, suffering from renal cirrhosis, was disturbed almost every morning between two and five by asthmatic paroxysms. His carbonaceous intake was largely reduced, his nitrogenous intake somewhat increased, and he was ordered to take regular systematic exercise, especially in the evening. On this treatment, he lost some weight and improved markedly in general health. Twelve months later he informed Dr. Hawkes, whose patient he was, that he remained quite free from his nocturnal asthma, except upon occasions which followed some departure from his prescribed routine (Case LXXXVI).

Manifestly both the headache in the first case and the asthma in the second were hyperpyraemic in origin, not

¹ *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 494.

uraemic, as we are sometimes inclined to infer. Such cases are extremely common; and their treatment is, in my experience, extremely satisfactory as far as regards the relief of the recurrent hyperpyraemic manifestations (compare § 578).

§ 891. SUGGESTIONS AS TO THE MECHANISM OF RENAL CIRRHOSIS.—Many authors have regarded the renal degeneration as anteceding and causing the general high blood-pressure and cardiac hypertrophy. George Johnson considered that, as a result of defective elimination on the part of the diseased kidneys, the blood becomes loaded with excrementitious material: that, as a consequence, the arterioles contract, thus exerting a 'stop-cock' function and resisting the passage into the capillaries of blood noxious to the tissues; and that this vaso-constriction, which is more or less continuous, is responsible for the persistent high blood-pressure, for the hypertrophy which he showed affects the circular muscular coat of the arterioles concerned, and for the cardiac hypertrophy which affects chiefly the left ventricle.

But Mahomed¹ showed that, in some cases at least, the high blood-pressure antecedes by long periods the renal degeneration. He argued—and in this he is followed by Saundby and others—'that the supposed impurity of the blood is due, not to imperfect excretory activity on the part of the kidneys, but rather to over-eating and over-drinking, by which it becomes charged with injurious matters.' This conception is consistent with the theory of hyperpyraemia. Hyperpyraemia results always from an income, that is, an intake and absorption, of carbonaceous material which is excessive relatively to the capacities of the organism for physiological acarbonization; and we have adduced much clinical evidence, not only of the pre-existence and co-existence of hyperpyraemia in cases of renal cirrhosis, but also of the causative relation of the hyperpyraemia to the renal cirrhosis. It remains, therefore, to determine, if possible, the means whereby hyperpyraemia leads to renal cirrhosis, that is, the mechanism of the disease.

In the first place, it may be stated that the acceptance of hyperpyraemia as a primary humoral factor of renal degeneration in no way entails the abandonment of that part of Johnson's view which asserts that the high blood-pressure is dependent on peripheral vaso-constriction. It has been argued

¹ *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 466.

throughout that hyperpyraemia is one of the commonest causes of exaggerated vaso-motor action ; and we may believe that hyperpyraemia is the chief humoral factor of, at any rate, the high blood-pressure which precedes the development of renal degeneration. With the development of renal degeneration, a second cause for high blood-pressure becomes added : this will be considered later (§ 900).

§ 892. What, however, is the mechanism of the renal degeneration ? Hyperpyraemia, we have seen reason to believe, is always attended by some degree of uricaemia due to retention ; and the dispersion of hyperpyraemia, however induced, is attended by the excretion of uric acid in excess, and by the consequent dispersion of the uricaemia (Chapters XIV and XV).

Further, it has been argued that these irregularities in the excretion of uric acid, which depend upon hyperpyraemia and subsequent acarbonization, are but exaggerations of the physiological fluctuations which depend upon physiological fluctuations in the carbon contents of the blood. It seems reasonable, therefore, to connect the commencement of renal degeneration with the exaggeration of the irregularities of uric-acid excretion, which depend essentially upon hyperpyraemia. This would be consistent with George Johnson's view that the epithelial cells are first affected, undergoing degeneration in consequence of having to perform unusual excretory work.¹

Now recurrent pathological acarbonization (except in the pathologically prepotent paroxysmal neuroses) implies recurrent hyperpyraemia ; and there is a not inconsiderable amount of clinical evidence which goes to show that some slight damage to the renal excretory tissues may occur with each paroxysm of such pathological acarbonization.

§ 893. Of *migraine*, Haig says :²—‘ I believe it is by no means very rare for sufferers from the uric-acid headache’ (*migraine*) ‘ to have a little albuminuria at the time of the attack or just before it is over, and some sufferers have albuminuria with their bad attacks, but not with their slight ones. My experience in this respect is by no means singular.’

The *asthmatic paroxysm* is often associated with slight temporary albuminuria. Dr. Hawkes informs me that at one

¹ *Theory and Practice of Medicine*, Roberts, 1883, p. 746.

² *Uric Acid in Disease*, 1897, p. 426.

time he examined systematically the urine in all the cases of asthma which came under his observation. This he did with the object of determining the influence of renal disease upon asthma; but he found that in most cases the albuminuria occurred only at the time of the asthmatic paroxysm.

Concerning *epileptic fits*, Gowers says:¹—‘Occasionally a trace of albumen is to be found in the urine first passed.’ He adds, however:—‘The frequency with which albumen is present has certainly been greatly exaggerated. Huppert has stated that its occurrence is almost invariable and that hyaline casts can frequently be found, but most subsequent investigators have failed to corroborate his assertion. . . . I found, however, in a case in which there was organic kidney disease, that the amount of albumen was distinctly increased after the fits. Dr. Beevor examined for me the urine after forty-two attacks in twenty-three patients. In only one instance did he find a trace of albumen, and in this case, after another attack, none could be found.’

Garrod says:²—‘Sometimes a very distinct trace of albumen is present in the urine in *acute gout*,’ though ‘the phenomenon is not, I believe, common in the early attacks.’ The damage to the kidney would probably be progressive: hence in early attacks albuminuria might not be noticeable. Samuel West says:³—‘In acute gout, the urine may temporarily contain albumen, usually as a trace only, or at any rate in small amount. Sometimes, however, it is present in considerable quantity. Thus I have seen specimens in which, on boiling, it was found to be half or more, and in one case the urine became solid. Yet, in all these instances alike, the albuminuria was transitory, lasting only during the acute stage, and after a few days disappearing entirely.’

§ 894. In what way may we suppose that the exaggerated fluctuations in uric-acid excretion damage the glandular structures of the kidney in all the above cases? Two views seem to suggest themselves:—1. The sudden excretion of uric acid in excess under pathological acarbonization following hyperpyraemia and uricaemia. 2. The retarded excretion of uric acid under hyperpyraemia.

¹ *Epilepsy*, 1901, pp. 127, 128.

² *Gout and Rheumatic Gout*, 1876, p. 133.

³ ‘On the Relation of Gout to Granular Kidney and to Lead-poisoning,’ by Samuel West, *The Practitioner*, July 1903, p. 35.

1. THE SUDDEN EXCRETION OF URIC ACID IN EXCESS UNDER PATHOLOGICAL ACARBONIZATION FOLLOWING HYPERPYRAEMIA AND URICAEMIA.—In acute gout, there is diminished excretion of uric acid antecedent to, and during the early part of, the articular paroxysm: a greatly increased excretion towards the middle or end of, and after, the paroxysm. A similar fluctuation, we have seen reason to believe, occurs with the paroxysms of all pathological acarbonizing processes which depend on hyperpyraemia. We might, then, regard the more or less sudden excessive excretion of uric acid, which results from the releasement of the uricaemia, as the instrument of the temporary renal lesion; and in support we might point to the time of occurrence of the albuminuria, which seems to coincide, in all cases, with the increase in uric-acid excretion.

Further confirmation of this view may perhaps be found in the following observations. ‘Ultzmann¹ has noticed in men, otherwise healthy, periodic albuminuria simultaneous with the evacuation of uric-acid crystals. He mentions that Leube had often found crystals of uric acid in the urine of patients who were affected by periodic albuminuria, and he satisfied himself that several individuals, described by Leube as having “physiological albuminuria,” had afterwards undoubtedly attacks of renal colic, and thereafter passed uric-acid concretions.’ ‘Jolles² . . . found the continuous evacuation of uric-acid crystals often accompanied by the presence of hyaline casts, although there were no other signs of kidney disease.’ ‘Sutherland³ found, in children with a tendency to uric-acid gravel, slightly periodic attacks of haematuria or albuminuria of very variable degree; casts were frequently present at the same time, though seldom in any quantity.’ Mygge⁴ investigated the urine of upwards of 200 individuals, taken without selection from the patients of the Kommune-hospital in Copenhagen: in more than one-third there was a decided deposition of uric-acid crystals, and in a considerable proportion of these the uric-acid gravel was accompanied by albuminuria. Levison says:⁵—‘During the last few years, I have always used the microscope in the examination of those urines which contained crystals of uric acid on elimination, or where such were deposited very shortly

¹ *Uric-acid Diathesis*, Levison, 1894, p. 117.

² *Ib.*

³ *Ib.*

⁴ *Ib.* p. 118.

⁵ *Ib.* p. 119.

afterwards. It has struck me that this condition was very frequently accompanied by casts in the urine.'

All these observations go to show that the excretion of urine containing, or about to contain, uric-acid crystals—one form of uro-lithiasis—may cause damage to the renal glandular tissues, sufficient to give rise to temporary albuminuria; and we have seen that uro-lithiasis is frequently an indication of the excretion of uric acid in excess (§ 636).

§ 895. 2. THE RETARDED EXCRETION OF URIC ACID UNDER HYPERPYRAEMIA.—This is the alternative view which suggests itself. There is, as we have seen, a diminution in the excretion of uric acid, antecedent to, and for a time accompanying, the acute gouty paroxysm: the same occurs, perhaps to a less extent, with the paroxysms of all pathological acarbonizing processes which succeed to hyperpyraemia; and this excretory fault has been ascribed to an inability on the part of the kidney to extract uric acid from over-carbonized blood. But it is obvious that such hyperpyraemic renal inability is only partial; for even during the stage of maximum uricaemia, which may be supposed to correspond roughly to the stage of maximum hyperpyraemia, some uric acid continues to be excreted. Consequently, it is open for us to conceive of this deficient excretion as implying excretion under difficult, or more or less unphysiological, conditions. Now such would probably involve a degree of damage to the renal excretory tissues; for I think it is generally true that work of any kind performed under unphysiological conditions involves a higher degree of strain than mere excess of work under physiological conditions.

On either of the above views, the uricaemia would be the cause, not the result, as Garrod is inclined to suppose, of a temporary renal lesion; and either is, so far as I can see at present, consistent with the general theory of hyperpyraemia. The second view does not perhaps fit in so well as the first with the exact time of occurrence of the temporary albuminuria during the course of a pathological acarbonizing paroxysm—unless, indeed, we might assume that the damage to the renal excretory tissue, though occurring during the period of diminished excretion, becomes manifest only during the subsequent period of increased excretion. Nevertheless, it is the view which I am about to adopt provisionally. And that

mainly on the following grounds:—It is in chronic, not in acute recurrent, articular gout, that, as Garrod has shown, the blood tends to be persistently rich, the urine persistently poor, in uric acid; and it is in chronic, not in acute recurrent, articular gout, that the kidneys are practically always to be found sooner or later in a state of more or less degeneration.

We may suppose, then, that just as recurrent hyperpyraemic uricaemia is capable of causing recurrent damage to the renal glandular tissue, so continuous hyperpyraemic uricaemia will be capable of causing continuous damage and progressive renal degeneration. As already pointed out, there is in chronic gout continuous hyperpyraemic uricaemia (§ 843); and it is in chronic gout that albuminuria is apt to be continuous and severe. In ten out of seventeen of Garrod's cases of chronic articular gout, in which the urine was examined during quiescent periods, albuminuria is 'stated to be present, and it is possible that in some of the remaining seven it might have existed, as its absence is not always specially noted.'¹

But chronic articular gout is only one manifestation of chronic hyperpyraemic uricaemia. Hence we shall expect to find uricaemia and renal degeneration associated in other circumstances. Conformably, 'Von Jaksch found uric acid in the blood in all cases of renal disease that he examined, the proportion being especially large in granular kidney disease and uraemia. Von Jaksch's results were confirmed by Klemperer, who examined the blood of cases of contracted kidney and found uric acid always present'² (Luff).

§ 896. Though we may accept the view that the prolonged renal excretion of uric acid under the obstructive conditions of hyperpyraemia is the dominant factor of renal degeneration, yet we are not called upon thereby to maintain that the prolonged renal excretion of uric acid in large amount, under other conditions, is altogether innocent of damage to the kidney. Conformably, J. Walker Hall³ points out that the purin bodies,—hypoxanthin, xanthin, uric acid, guanin, adenin, and methyl-xanthins, all of which are now regarded as sources of urinary uric acid—though they exert no immediate action, 'in long-continued small doses are not entirely harmless . . .

¹ *Gout and Rheumatic Gout*, Garrod, 1876, p. 134 *et seq.*

² *Gout, its Pathology and Treatment*, A. P. Luff, 1898, pp. 50, 51.

³ *Report LXVIII of the Scientific Grants Committee of the Brit. Med. Assoc.*

Kolisch, Dostal, and Croftan have produced lesions of the renal cells and arterioles by the injection of certain purin bodies in animals.'

At any rate, it will be admitted that in renal cirrhosis, as in articular gout, the uricaemia is a more proximate factor than the hyperpyraemia: as Saundby says,¹ 'both the joint affection and the kidney disease depend upon accumulation of uric acid in the blood.' And it is reasonable to suppose that in the renal affection the damage to the kidney will be, other things equal, roughly proportionate to the amount, that is, the intensity and duration, of the uricaemia. But the amount of the uricaemia—hyperpyraemic uricaemia, that is to say—will depend upon at least two circumstances: (1) upon the duration of the hyperpyraemia (§ 631), which again will depend, *inter alia*, upon the infrequency of recurrent acarbonization; and (2) upon the amount of uric acid-forming material introduced with the food. Now women possess a physiological recurrent acarbonizing process in menstruation: they suffer, as we have argued, more than men from the commoner and milder neurosal acarbonizing processes, such as recurrent headache with loss of appetite and dyspepsia; and their food habits, it will be admitted, involve on the average a smaller introduction of uric acid-forming material than do the food habits of men. Hence, on all these grounds, we shall expect to find a preponderance of renal cirrhosis, as well as of articular gout, in the male sex.

Conformably, we find that the preponderating incidence of renal cirrhosis upon the male sex, though not so marked as is that of articular gout, is still 'an incontestable clinical fact.' Saundby says:² 'All statistics agree that the contracting type of kidney is less common in females than males. This is true, but the truth would be more striking if the figures were not vitiated by two circumstances, namely, the frequency of contracting kidney of obstructive origin in women with pelvic diseases, and secondly, the fact that contracting kidney may be of infective origin.'

§ 897. GENERAL CONCLUSIONS AS TO THE PATHOLOGY OF RENAL CIRRHOSIS.—We may conclude that for the production of renal cirrhosis to an even greater extent than for the production of articular gout, a prolonged uricaemia depending on a prolonged hyperpyraemia, is necessary. Hence renal

¹ *Renal and Urinary Diseases*, Saundby, 1896, p. 119.

² *Ib.* p. 117.

cirrhosis appears as the ultimate manifestation of hyperpyraemia, much more frequently in those who have suffered in the past from recurrent acute gout, than in those who have suffered from those more frequently recurring acarbonizing processes, bilious attacks, the paroxysmal neuroses, etc. The paroxysmal neuroses, more especially of course the pathologically prepotent paroxysmal neuroses, and all other frequently recurring acarbonizing processes, are preventives of acute articular gout; and the whole series, including acute articular gout, are preventives of renal cirrhosis. Further, they are efficient as preventives in proportion to their frequency and to their efficiency in promoting acarbonization. They may all appear in the life-histories of different cases of renal cirrhosis, but they are to be regarded as attempts to disperse the common humoral cause; and the development of the renal cirrhosis must be accepted as an index of their ultimate failure.

§ 898. RENAL CIRRHOSIS A PREMATURE PHYSIOLOGICAL DEGENERATION.—It has been argued (1) that physiological high carbon contents of the blood tends to cause uricaemia through retardation of renal excretion: (2) that pathological high carbon contents of the blood, or hyperpyraemia, causes pathological uricaemia through a correspondingly increased retardation of renal excretion; and (3) that the excretory retardation involves a corresponding degree of wear, or damage, on the part of the renal excretory tissues. Hence it would seem that the pathological influences which mainly conduce to renal cirrhosis are to be regarded for the most part as mere exaggerations of the physiological influences which would probably lead in any case eventually to renal degeneration, did death not intervene from other causes. Renal cirrhosis would thus be premature physiological degeneration.

Consistent with this deduction is the observation that renal cirrhosis 'is rare under twenty years of age, less rare up to forty, becomes common after that period is passed, and after fifty is so common that nearly one-third of all persons dying above that age show more or less signs of its action in their kidneys'¹ (Saundby).

¹ *Renal and Urinary Diseases*, Saundby, 1896, p. 117.

THE MEANING AND MECHANISM OF THE HIGH BLOOD-PRESSURE OF RENAL CIRRHOSIS

§ 899. A short review of some of the numerous ways in which peripheral vaso-constriction acts conservatively in the various physiological and pathological processes of the organism will, I think, serve to lead up by natural steps to an elucidation of the meaning and mechanism of the well-known persistent high blood-pressure almost invariably associated with renal cirrhosis.

It has been argued that when the blood contains an excess of fuel the organism strives to limit the supply to the tissues by the means most ready to hand, namely, vaso-constriction (§ 350). But vaso-constriction, through its tendency to raise blood-pressure, involves, in many cases, compensatory vaso-dilation in other areas, or, failing adequate compensatory vaso-dilation, compensatory cardiac inhibition. Either form of compensation may become the instrument of acarbonization. Thus vaso-dilation affecting the hepatic artery is probably the instrument of the acarbonizing glycogenic distension of the liver in bilious attacks, recurrent secondary dyspepsia, migraine, etc.: vaso-dilation affecting the bronchial area is the instrument of the decarbonizing dyspnoea of asthma; and cardiac inhibition is the instrument of the decarbonizing convulsions in some cases of major epilepsy. Thus, in all these cases, vaso-constriction is in a sense doubly conservative: while it operates directly to relieve the strain upon the decarbonizing functions of the tissues, it operates only a little less directly to bring about complex pathological acarbonizing paroxysms, which result in the restoration, more or less complete, of the physiological condition of the blood.

But apart from the necessity which may arise for shielding the tissues or organism generally from the effects of an excessive fuel supply, vaso-constriction has many conservative purposes. The functional activity of the organs and tissues of the body is ever-varying; and variations of functional activity demand corresponding variations in the supply of arterial blood. An increase of arterial blood to an actively functioning part can be assured only by dilation of the supplying arteries; but such vaso-dilation, through its tendency to lower

blood-pressure, will demand vaso-constriction elsewhere, and this will naturally occur in parts which are less actively functioning at the time. Many illustrations might be given, but the cutaneous vaso-constriction associated often with the vasodilation of the alimentary mucosae during the early stages of digestion will serve as an example.

In many, perhaps in the majority of, such cases, the vasodilation is accurately balanced by the vaso-constriction: hence no alteration of the heart's action is demanded and none occurs. But it may happen that the arterial blood required by some portion of the organism is more than can be supplied by local vasodilation supplemented only by vaso-constriction elsewhere. Then there is demanded, in addition, an increase in the work done by the heart; and this can be perceived in many instances. By means of a widespread vaso-constriction supplemented by increased cardiac action, there may be attained the maximum supply of arterial blood in any vasodilated area. Such, we have seen, is the meaning of the physiological high blood-pressure of utero-gestation (§ 736); and such, I shall presently argue, is, *in great part*, the meaning of the pathological high blood-pressure of renal cirrhosis.

It cannot, I think, be disputed that, as a general rule, renal cirrhosis is associated with a higher degree of blood-pressure than are other pathological conditions which depend directly or indirectly on hyperpyraemia; nor can it, I think, be disputed that this raised blood-pressure tends to increase—at any rate, to continue—so long as the patient is holding his own. And although we may fully subscribe to the opinion that the high blood-pressure often precedes the renal degeneration, yet we are not called upon to deny that the development of renal degeneration materially increases the blood-pressure.

§ 900. Here, it seems to me, is the opportunity for Cohnheim's theory. As Fagge states,¹ Cohnheim 'gave reasons for thinking that the activity of the circulation through the kidneys at any moment—in other words, the state of the smaller renal arterioles as regards contraction or dilatation—depends not (as in the case of the tissues generally) upon the need of those organs for blood, but solely upon the material for the urinary secretion that the circulatory fluid happens then to contain. This suggestion has bearings upon the development of hypertrophy

¹ *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 467.

in one kidney when the other has been entirely destroyed. But another consequence deducible from it is that when parts of both kidneys have undergone atrophy, the blood-flow to the parts that remain must, *ceteris paribus*, be as great as it would have been to the whole of the organs, if they had been intact. In order, however, for such a quantity of blood to pass through the restricted capillary area now open to it, an excessive pressure is obviously necessary. This can be brought to bear only by increased energy in the pulsations of the left ventricle, combined with the maintenance of a corresponding resistance in all other districts of the arterial system. And so one can account at once for the high arterial pressure and for the consequent cardio-vascular changes.'

Cohnheim's views are entirely consistent with the following:—

1. George Johnson's view (which is here adopted) that the increased peripheral resistance in renal cirrhosis depends upon continuous vaso-constriction of the systemic arterioles, reflex through the vaso-motor centre.¹ Such continuous vaso-constriction demands, and is ultimately succeeded by, myo-hypertrophy of the tunica media.

2. Thoma's histological researches which demonstrate that vaso-dilation is the ruling condition of the renal arterioles in cirrhosis of the kidney. Such protracted vaso-dilation demands compensatory hypertrophy of the tunica intima of these vessels; and, as already stated (§ 878), William Russell has shown that while the media is not appreciably thickened and may even be atrophied, the intima is greatly thickened.

3. The clinical fact called attention to by Broadbent in the following words:²—‘It is clear enough why, when the resistance in the capillaries’ (the increased peripheral resistance is here regarded as localized in the arterioles, but that is immaterial in this connexion) ‘is increased, inadequate propulsive power on the part of the heart is of unfavourable prognostic import; but it is not so clear why absence of peripheral obstruction should be a bad sign; but so it appears to be.’ It is probably only by means of widespread peripheral vaso-constriction, plus increased propulsive power on the part of the heart, that the blood can be carried through the dilated arterioles of the

¹ *Renal and Urinary Diseases*, Saundby, 1896, p. 48.

² *The Pulse*, W. H. Broadbent, 1890, p. 253.

atrophic kidney with sufficient rapidity to clear it of material for renal elimination.

4. The recently expressed views of Claude and Burthe ('Biochem. Centralbl.', February 1902). These observers 'have made a large number of observations on the elimination of the solids of the urine in patients suffering from this disease, fed on a constant diet. The urine was examined chemically, and also by a cryoscopic method. They found, confirming the work of others, that both the saline and the nitrogenous constituents of the urine were excreted usually in normal, or even in more than normal, quantity. The danger of the disease lies in the ease with which any disturbing cause, such as an infection or an intoxication, leads to a sudden fall of excretory power. They point out that the continuance of a sufficient excretion depends on the integrity of that part of the kidneys which is still functionally active, and on the maintenance of the raised arterial tension and the efficiency of the hypertrophied heart. Any interference with these three interdependent factors is liable to cause a failure of excretion and bring on uraemic manifestations.'¹ These considerations cast a grave doubt upon the expediency of prescribing the nitrites in renal cirrhosis, except as a mere emergency measure in cardiac failure.

5. The occurrence of similar cardio-vascular changes in atrophy of the kidney from hydro-nephrosis. This observation is adduced by Fagge² in support of Cohnheim's view. In a case of renal tuberculosis with occluded ureter and hypertrophy of the other kidney, Dr. J. M. Jackson³ of Boston, U.S.A., found a sphygmometric registration of 250 millimètres, the highest pressure that could be registered on the instrument used.

Thus, in many cases of renal cirrhosis, there is a history of high blood-pressure which has long anteceded the development of the renal lesion. This high blood-pressure may be regarded as a manifestation of hyperpyraemia, the humoral condition which is the primary cause of the renal cirrhosis. But the development of renal cirrhosis increases the demand for high blood-pressure, which consequently then becomes more conspicuous than heretofore. This twofold causation and meaning

¹ *Brit. Med. Journal*, March 28, 1903, Epitome.

² *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 467.

³ *Lancet*, March 28, 1903, p. 906.

of high blood-pressure in cases of renal cirrhosis did not escape the keen clinical intuition of Duckworth, who says of the vascular condition under consideration :—‘ It may occur long antecedent to cirrhosing change in the kidneys, but is probably often in relation to that change, and may be expected in association with it.’¹

§ 901. THE POLYURIA OF RENAL CIRRHOSIS.—While Cohnheim’s theory as it stands fully accounts for the maintenance of the normal amount of urinary excretion by the greatly contracted organs in renal cirrhosis, it does not, without further elaboration, account for the actually increased diuresis which seems almost the rule in this affection.

Chronic increased diuresis must be associated with an habitual increase in the intake of fluid; and this will depend, in practically all cases, upon an increase of thirst. Now, according to Foster,² ‘ the sensation of thirst is brought about by afferent impulses started in the mucous membrane of the soft palate by a deficiency of water in that membrane, perhaps by a drain on the lymph spaces in that membrane.’ But ‘under ordinary circumstances . . . the condition of thirst is brought about, not by anything bearing specially or exclusively on the mucous membrane of the soft palate or even of the whole mouth, but by a diminution of the water present in the body. . . . This is often spoken of as a diminution of the water of the blood; but most probably the specific gravity of the blood is kept constant by the withdrawal of water from the lymph, so that the loss falls on the latter fluid’³ (Foster).

Thus deficiency of water in the tissues may be regarded as the essential factor in the sensation of thirst. But the lymph which bathes the tissues is derived from the blood: hence deficient blood supply to the tissues will lead to deficiency of water in the tissues. Now peripheral vaso-constriction will occasion deficient blood supply to the tissues; and numerous clinical observations might be adduced to show that peripheral vaso-constriction is apt to be associated with thirst. For example, widespread peripheral vaso-constriction occurs in an acute form in the cold stage of the ague paroxysm; and Fagge says⁴ that ‘ the patient during this stage feels dry and parched.’

¹ *Treatise on Gout*, Duckworth, 1890, p. 300

² *Text-book of Physiology*, M. Foster, 1891, p. 1423.

³ *Ib.*

⁴ *Text-book of Medicine*, Fagge, 1891, vol. i. p. 324.

In a patient of mine, marked cutaneous vaso-constriction, evidenced by pallor and chilliness even in the hottest weather, antecedes by three or four days the onset of the menstrual flow at every period ; and on all of these days there is, amongst other symptoms, continual thirst and much increased diuresis.

Now in renal cirrhosis there is, as already argued, continuous peripheral vaso-constriction : this will result in a continuously deficient blood-supply to the tissues. Consequently in this disease we shall expect to find the manifestations of deficient supply of blood and fluid to the tissues in a chronic form. Of these, the most conspicuous will be pallor and dryness of the skin, which will present a shrunken or withered appearance with accentuation of lines and wrinkles in the face—just such an appearance as is to be observed in a more acute form during the cold stage of the ague fit ; and a more or less continuous sensation of thirst. These anticipations seem fully confirmed on appeal to clinical observation. The appearance of the face and skin generally, which has just been described, will be admitted to be the appearance commonly noted ; and thirst, though not perhaps strongly insisted upon in most text-books of medicine, is, in my experience, an almost invariable symptom in renal cirrhosis.

That the pallor observed in renal cirrhosis is often due to cutaneous vaso-constriction, and not to deficiency of haemoglobin or diminution in the number of red corpuscles, seems inferable from the accurate work recently done in haematology. James Ewing¹ points out that in many cases of renal cirrhosis ‘the blood remains practically normal’ ; and that ‘many patients are carried off by acute uraemia and other terminations of interstitial nephritis before the blood is markedly altered.’

§ 902. It is customary to ascribe the thirst associated with renal cirrhosis to the increased diuresis ; thus Fagge says² that ‘when the flow is much increased with consequently great thirst, patients sometimes take alarm and seek advice for what they imagine to be diabetes.’ But Fagge’s view seems to me an inversion of cause and effect. It seems more reasonable, as is here done, to regard the peripheral vaso-constriction as primary : the thirst, increased ingestion, and increased excretion

¹ *Clinical Pathology of the Blood*, Ewing, pp. 363, 364.

² *Text-book of Medicine*, Fagge, 1891, vol. ii. p. 498.

of water, as all secondary thereto. It must be admitted, however, that on this view there is in operation a distinctly appreciable and highly vicious circle. The circle comprises continuous vaso-constriction: deficiency of water in the tissues: thirst: increased ingestion of water; and increased diuresis. The water drunk does not adequately relieve the thirst, since it fails, on account of the peripheral vaso-constriction, to flush adequately the tissues and thus to remove the essential cause of the thirst: in other words, the water drunk is largely short-circuited through the kidneys.

This view is, I think, confirmed by the influence of vapour baths and the administration of drugs, such as nitro-glycerine, in renal cirrhosis. I have already suggested that the sensation of comfort which follows these therapeutic measures is explicable by the relaxation of peripheral arterial spasm (§ 761). Such relaxation will permit the penetration of an increased amount of fluid into the lymph spaces of the tissues, and so will diminish thirst; and I have no doubt, from clinical observation, that this result is often attained. I have found that thirst is diminished by nitro-glycerine more effectively than by an increased ingestion of fluid.

In one of my cases, the administration of one minim of liquor trinitrini every four hours was followed by a decrease in the flow of urine of from nearly six to three pints per diem: the patient was called upon to pass water during the night three times only, as against every hour or hour and a half previously; and he found that his thirst diminished so much that his daily allowance of milk—two pints with a little soda water—was sufficient without additional fluid.

Thus, in renal cirrhosis, the increase in the quantity of urine over and above the amount passed in healthy persons is, on this view, a mere incidental and unfortunate result of the circulatory changes instituted by the organism to maintain the ordinary rate of excretion. Consistent with this are the recent investigations by Mohr and Dapper on the influence of the amount of fluid ingested upon the functions of diseased (cirrhotic and other) kidneys.¹ These investigations showed that neither in acute nephritis nor in the granular contracted kidney does a moderate limitation (down to three pints) of the fluid intake produce any marked influence upon the elimination

¹ *Brit. Med. Journal*, December 19, 1903, Epitome, pp. 93, 94.

of nitrogenous substances or of phosphoric acid. When the amount of fluid is still further reduced, the excretion of these bodies is diminished.

ARTERIO-SCLEROSIS AND RENAL CIRRHOSIS COLLOCATED AND DIFFERENTIATED

§ 903. Arterio-sclerosis and renal cirrhosis are so constantly associated that, by general consent, they are regarded as closely connected in their pathology. As to the nature of the pathological connexion, however, many opinions have been expressed. The renal cirrhosis has been regarded as primary, the arterio-sclerosis as secondary, due to imperfect elimination of waste urinary materials and consequent prolonged vascular irritation by impure blood: the arterio-sclerosis has been regarded as primary, the renal cirrhosis as secondary to arterio-sclerosis of the renal arterioles: recently there has been a tendency to refer both arterio-sclerosis and renal cirrhosis to uricaemia; and other views have been expressed.

In accordance with the views adopted in this work, the pathology of the two conditions may be epitomized in a tabular form as below:—

TABLE IX.

Hyperpyraemia, possibly in some degree directly responsible
for depraved nutrition of arterial coats and renal excretory tissues.

Peripheral vaso-constriction, leading to hypertrophy of the tunica media, with subsequent degeneration.	Uncompensated, or inadequately compensated, by vaso-dilation	Compensated wholly or in part by vaso-dilation.	Uricaemia.
			Unphysiological excretion of uric acid: physiological strain.
Central, as well as peripheral, intra-vascular strain.	Intra-vascular strain in dilated area.	Injury, degeneration, and atrophy of the renal glandular tissues.	Injury, degeneration, and atrophy of the renal glandular tissues.
			Compensation increase in general blood-pressure, due to increased peripheral vaso-constriction and cardiac hypertrophy, associated with dilation of the renal arterioles.
Compensatory sclerosis of main arterial trunks, e.g. the aorta, and of the cardiac valvular structures, etc.	Irregular, and more or less localized, compensatory arterio-sclerosis, e.g. of the temporal in some cases of migraine.	Compensatory sclerosis of renal arterioles and ultimately of other arterial areas, with subsequent degeneration.	Compensatory sclerosis of renal arterioles and ultimately of other arterial areas, with subsequent degeneration.
			Compensatory sclerosis of renal arterioles and ultimately of other arterial areas, with subsequent degeneration.

The table shows that both arterio-sclerosis and renal cirrhosis may depend primarily upon hyperpyraemia; and it suggests that depraved nutrition, due directly to the unphysiological nature of the blood-supply, may be a factor in both forms of degeneration. Thereafter, the development of the two pathological conditions diverges.

On the one hand, peripheral vaso-constriction, which has been so often ascribed to hyperpyraemia, tends to cause, when frequently repeated or prolonged, hypertrophy of the tunica media. The rise of blood-pressure, which peripheral vaso-constriction tends to cause, may be (1) uncompensated, or inadequately compensated, by vaso-dilation; or it may be (2) compensated, wholly or in great part, by vaso-dilation. In the first case, the whole circulatory system will suffer more or less from strain, and we shall have sclerosis of large arterial trunks and, in many cases, of the cardiac valves. In the second case, it will be mainly the dilated area which will suffer from intravascular strain, and we shall have more or less localized, if not patchy, areas of arterio-sclerosis, as has been observed in the temporal artery in some cases of migraine.

On the other hand, hyperpyraemia leads to some degree of uricaemia; and uricaemia, in the presence of hyperpyraemia, implies the unphysiological excretion of uric acid. The physiological strain so induced causes injury, and subsequent degeneration and atrophy, of the glandular structures of the kidney. The diminution in the amount of excretory tissue so brought about demands the compensatory acceleration of the blood-flow through the remaining functionally active tissue; and this can only be attained through compensatory increase in the peripheral vaso-constriction, together with increased action on the part of the heart. Hence the extremely high blood-pressure and cardiac hypertrophy, most marked in the left ventricle, almost invariably associated with advanced renal cirrhosis. It must be admitted, however, though such high blood-pressure and cardiac hypertrophy are essential to the interests of the organism suffering from renal cirrhosis, that the high degree of intravascular strain involved must be an important additional factor in arterio-sclerosis and general circulatory degeneration. It is clear, then, that uricaemia may play a part in circulatory degeneration; but it is equally clear that such part is very indirect.

§ 904. CONFIRMATORY VIEWS AND OBSERVATIONS.—The above view of the pathology of these two commonly associated, but separable, pathological processes, will, I think, be found to harmonize with a larger number of accredited observations than any other; and it will be found to conform in many respects with the present views of some of the highest authorities. It is consistent with the frequent association of the two processes; it is consistent also with the frequent occurrence of either process without the concurrence of the other, at any rate in any marked degree. It accords with the view that ‘the first deviation from health is not arterial disease, but rise of blood-pressure, the arterial disease being secondary and due to strain’¹ (Allbutt); and with the view that ‘granular kidney . . . is the result of a protracted submission of the whole kidney to the action of some poison . . . which has primarily a necrosing effect on the secreting, and an irritating effect upon the connective, elements’² (Allbutt); for uric acid in excess in over-carbonized blood involves, as we have seen, unphysiological excretion, and, therefore, from the standpoint of the kidney, may be regarded as of toxic influence.

Further, the view here adopted explains, in some degree, the incidence of the two pathological conditions upon the male and female sexes respectively. Though arterio-sclerosis is less frequent in women before the menopause than in men of a corresponding age, yet it is equally, or even more, frequent thereafter (§ 872); and it seems probable that the frequency, irrespective of age, is nearly equal. Mott says:³—‘McCrorie, on examination of the post-mortem records at Glasgow, found that the disease was as frequent in women as in men.’ And Clifford Allbutt says:⁴—‘We must admit that atheroma is as likely to occur in the *elderly* lady, who has spent her life in trotting amiably about the parish, as in her husband.’ (Italics mine.) On the other hand, we have seen that renal cirrhosis is at least twice as common in men as in women. The relatively small importance of uricaemia in the arterial, its preponderating importance in the renal, affection, seem sufficient to account for this difference in sex incidence. For it seems probable that the hyperpyraemic

¹ *Lancet*, March 7, 1903, p. 648.

² *Ib.*

³ *System of Medicine*, Clifford Allbutt, vol. vi. p. 321.

⁴ *Ib.* vol. v. p. 910.

uricaemia which is most deleterious to the renal excretory tissues is a prolonged or unrelieved hyperpyraemic uricaemia ; and it has been argued that men, more than women, are liable to prolonged hyperpyraemia (§ 608). Besides which, it will be admitted that the food habits of men imply on the average a greater introduction of uric acid-forming material than do the food habits of women. So probably, to a great extent, it has come about that in the case of the hyperpyraemic degenerations, arterio-sclerosis and renal cirrhosis, just as in the case of the hyperpyraemic acarbonizing processes, the paroxysmal neuroses and acute gout, men are more prone than women to those affections in which the uricaemia constitutes an essential factor in the pathological mechanism.

CLASSIFICATION OF HYPERPYRAEMIC DEGENERATIONS

§ 905. In pursuing the evolution of hyperpyraemia, we cannot fail to be struck by the fact that the farther we go the more complex becomes the tangle of interacting factors the more numerous, consequently, the resulting clinical and pathological manifestations. It is clear that the hyperpyraemic degenerations must be placed towards the very end of the more or less conservative, yet pathological, series of processes which commence with the ultra-physiological humoral condition. And it is equally clear that no complete scientific or natural system of classification is possible, until we are in a position to define, much more clearly than at present, the influence of all the other members of the series. Yet it may be suggested that the fundamental dividing lines for such a classification should conform to those we have used in attempting to classify the earlier manifestations of hyperpyraemia. Many degenerative conditions depend less upon the hyperpyraemia than upon the pathological acarbonization to which the hyperpyraemia gives rise : many more depend upon the results of unrelieved hyperpyraemia ; and in a certain proportion of either class, the secondary uricaemia is the determining factor.

CHAPTER XXV

§§ 906–929

Recapitulation and general correlation—The conservative principle involved in the theory of hyperpyraemia—General conclusions and concluding remarks.

§ 906. We have separated the constituents of the food-supply into two fundamental divisions, the nitrogenous and the carbonaceous; and we have seen reason to believe that these differ essentially in their uses and in their effects upon the organism. The nitrogenous or proteid division, corresponding as it does to the building material of the steam-engine, is adapted to the stimulation and repair of the functioning tissues, and thus dominates function of all kinds: amongst other things, it dominates both the carbonization and the decarbonization of the blood—that portion of the latter process which consists of restriction of income, and that also which consists of expenditure or decarbonization, katabolic, anabolic, and through direct loss. On the other hand, the carbonaceous division, consisting of the fats and carbohydrates, corresponds to the coal of the steam-engine and constitutes the fuel of the human organism. It must, however, be admitted that the steam-engine analogy is imperfect. Proteid consists of a carbonaceous, as well as a nitrogenous, part; and the organism undoubtedly possesses, in certain circumstances, the power to utilize the former as fuel; and it may be that it exercises this power, to some extent, in *all* circumstances.

From a consideration of what is known of the laws of nitrogenous metabolism, we have inferred that the nitrogen contents of the blood tend to remain uniform, and that, consequently, there is little danger of any *primary* accumulation of nitrogenous material occurring therein. On the other hand, from a consideration of what is known of the laws of carbonaceous metabolism, we have inferred that even in physiological

life there is a tendency to variation in the carbon contents of the blood.

§ 907. The variations in the carbon contents of the blood are due to the intermittence in the food-supply: to the fluctuations, irregular and cyclical, in the rate of combustion; and to the tendency to inter-menstrual accumulation inherent in the mature non-pregnant female. Normally, the carbon contents of the blood are prevented from rising to any pathological height by the restriction of carbonization, through physiological distension of the liver by glycogen: by the limited power of the organism to increase the rate of combustion in response to the presence of carbonaceous material in the blood: by the subconscious impulse to increase physical exercise in accordance with the necessity for decarbonization: by the power to construct fat, utero-gestation, and other anabolic capacities: by the periodic haemorrhage of menstruation; and possibly by other physiological functions less well understood. As regards the mechanism of these automatic functions, there cannot be much doubt that the first and last named, at any rate, are essentially vaso-motor; and it is possible that this is true also to some extent of the rest.

All these capacities, however, are operative only within certain limits: this is conspicuously true even of the fat-forming capacity which, we are apt to assume, is always adequate, and which probably *is* the most important normal means of removing superfluous carbon from the blood. It is necessary, therefore, in order to avoid physiological strain, that the food-supply should approximate both in kind and in quantity to a certain physiological ideal; the which, however, varies no doubt widely with the individual and with circumstances.

Such an ideal is doubtless attained instinctively in the lower animals and in primitive man through natural selection operating under a stable environment. But the growth of reason and the rapidly changing environment of advancing civilization involve the loss of instinctive guidance in food customs. Consequently, pending the full development of reason, we are left largely at the mercy of chance as regards the attainment of a physiological diet.

So arise what we may term fundamental food errors. Two

of these, namely, excessive nitrogenous, and deficient carbonaceous, intake, are probably unimportant, since, under ordinary conditions, they tend to be rapidly adjusted by a self-regulating power of the organism. Other two, namely, deficient nitrogenous intake and excessive carbonaceous intake, are important because they do not *necessarily* undergo such rapid automatic adjustment.

§ 908. Deficient nitrogenous intake *may* undergo adjustment by the individual organism or through evolutionary processes. Failing adjustment, there will be progressive impairment of function. Such impairment may affect the carbonizing and decarbonizing functions proportionately: in this case, there may be a continuance of physiological life, but upon a lower level of vitality, so to speak. On the other hand, the impairment may affect either set of functions disproportionately: in this case, there will be a progressive failure of physiological action. Should the functional failure affect preponderatingly the carbonizing functions, there will be deficient supply of carbonaceous material or fuel to the blood-stream: the deficiency will be compensated for a time by a corresponding withdrawal from the tissues. Should the functional failure affect preponderatingly the decarbonizing functions, there will be an excessive supply of carbonaceous material or fuel to the blood-stream: the excess will constitute hyperpyraemia.

Excess of carbonaceous or fuel supply is the other important fundamental food error. This also *may* undergo adjustment by the individual organism or through evolutionary processes. In the absence of adjustment, however, there will result an intrusion into the blood-stream of carbonaceous material or fuel, which is beyond the physiological acarbonizing capacities of the organism.

Thus hyperpyraemia may arise primarily through a deficiency of nitrogenous, or through an excess of carbonaceous, supply. In the latter case, there need be no actual functional impairment: in the former, functional impairment is a necessary antecedent of hyperpyraemia. And it must, of course, be freely admitted that functional impairment responsible for hyperpyraemia may arise from numerous causes other than deficient nitrogenous intake.

§ 909. But, whatever its origin, the further evolution of hyperpyraemia will be determined by a multitude of circum-

stances: some of these concern the environment and are more or less accidental, while others depend upon the inherent or acquired proclivities and capacities of the organism. Thus hyperpyraemia may be dispersed by the repair through altered environment of the originally impaired physiological process, as when combustion which has fallen in power is raised through an addition to the proteid intake or through increased exercise, or as in the case of the re-establishment of menstruation: by a substitutive exaggeration of some other physiological process, as when obesity or menorrhagia supervenes and compensates for the retarded combustion of tropical life or deficient physical exercise: by the substitution of some incidental physiological process, such as utero-gestation: by incidental pathological processes, such as some primary dyspeptic conditions or some specific fevers; and failing these, by pathological processes which depend upon hyperpyraemia. Finally, it may happen that hyperpyraemia remains unrelieved and continues as a more or less chronic condition.

The pathological acarbonizing processes which depend upon hyperpyraemia present wide diversities in their clinical manifestations; yet, as implied in the title here adopted, they concur in at least two respects when viewed from a fundamental pathological standpoint: (1) they depend upon one and the same overburdened condition of the blood; and (2) they are adapted to relieve or disperse this humoral condition.

§ 910. Concerning the means whereby the pathological acarbonizing processes achieve this end, it seems clear that these may be regarded, in most cases, as variations—exaggerations with modifications—of the means whereby in physiological life the carbon contents of the blood are prevented from rising unduly: hence the graduation of physiological into pathological acarbonization. The purely physiological means referred to comprise the regulation of the carbonaceous income through the glycogenic function of the liver, and the carbonaceous expenditure by katabolism (combustion), anabolism (fat-formation, etc.), and direct loss (menstrual haemorrhage).

The pathological acarbonizing processes may employ any or all of these means. Some, like secondary dyspepsia and anorexia, bilious attacks, migraine, and gastralgic paroxysms, operate mainly through exaggerated or prolonged restriction of income. Others operate mainly through some form of increased

expenditure. The increased expenditure may concern catabolism, anabolism, or direct loss. The increased catabolism may be a response to increased muscular exertion, as in epilepsy, asthma, and angina ; or it may consist of an increase of the continuous combustion which is essential to, and ever-present during, life, as in pyrexia. Tumour, especially malignant tumour, formation is an example of anabolic decarbonization ; and it may possibly be a response in some degree to hyperpyraemia. Menorrhagia, certain ‘idiopathic’ haemorrhages, probably glycosuria, are examples of pathologically increased decarbonization by direct loss ; and probably all of them may be ascribed in some cases to hyperpyraemia, or to the causes or results of hyperpyraemia.

But probably all the pathological acarbonizing processes achieve their aim to some extent complexly—they do not restrict themselves, so to speak, to any single means of acarbonization. Secondary dyspepsia, biliary attacks, migraine, etc., which operate mainly by restriction of income, may in some cases, especially in children, be associated with the increased catabolic expenditure involved in rigor and pyrexia : affections, such as asthma and epilepsy, which operate mainly through the increased catabolic expenditure involved in enforced muscular exertion, may be associated with restriction of income through glycogenic distension of the liver and with pyrexia : essentially pyrexial processes, like acute gout, may be associated with glycogenic distension of the liver and consequent anorexia and dyspepsia, or with an exacerbation of acne indicating an attempt at decarbonization through increased anabolism ; while there are occasional instances in which decarbonization by direct loss (very rarely glycosuria, not infrequently haemorrhage) is superadded to the pathological acarbonizing processes already indicated. Thus it would appear that all the means employed in physiological acarbonization may enter in various proportion into any of the pathological acarbonizing processes.

§ 911. Concerning the mechanisms of the pathological acarbonizing processes, it seems clear that these also however complex, may be regarded in many cases as variations—exaggerations with modifications—of physiological mechanisms. The chief physiological mechanisms here referred to are the vaso-motor and the cardio-inhibitory mechanisms. In health,

the blood-supply to the different tissues and organs of the body is continually varying in accordance with continual fluctuations of functional activity and with frequent changes of external conditions, thermic and other: such localized variations of blood-supply are effected through variations in the diameter of the afferent arteries under the influence of the vaso-motor nerves. But it is a physiological canon that the mean blood-pressure shall remain constant or nearly so. Hence it is found that a vaso-dilation of one or more areas is associated with a vaso-constriction of other areas; and conversely. In many cases, doubtless in the vast majority, the net result upon the mean blood-pressure is nil: vaso-dilation and vaso-constriction are in accurate counterpoise. But it may happen in less usual circumstances, that the balance between these opposite vascular conditions is inaccurate: then, so essential is the maintenance of a constant mean blood-pressure that further compensation in the shape of variations of cardiac action are introduced. Should the combination of vaso-dilation and vaso-constriction tend to cause a rise of blood-pressure, cardiac action is slowed, perhaps also weakened, correspondingly: should there result a tendency to fall of blood-pressure, cardiac action is accelerated, perhaps also strengthened, correspondingly. These cardiac variations depend upon the cardio-inhibitory and upon the accelerator or augmentor mechanisms.

These various compensatory physiological mechanisms may be observed in operation in exaggerated degrees in the affections termed 'paroxysmal neuroses'—affections which constitute a rather well-defined subordinate group of the pathological acarbonizing processes. In migraine, which may be taken as a type of those paroxysmal neuroses which achieve acarbonization through restriction of income, there is commonly a widespread cutaneous vaso-constriction, more or less compensated by internal areas of vaso-dilation. The vaso-dilation which affects the cranial area, and which is the proximate cause of the headache and other distinctive, though unessential, symptoms, may probably be regarded as unfortunate and in a sense accidental: the vaso-dilation, which I have inferred affects the hepatic artery, is probably the proximate cause of the conservative glycogenic distension of the liver. In both asthma and major epilepsy, affections which may be taken as types of those paroxysmal neuroses which achieve acarbonization through the

exaggerated katabolic expenditure of enforced muscular exertion, there is also a widespread vaso-constriction which, in most cases at least, affects mainly the cutaneous area. In asthma, the compensatory vaso-dilation affects the bronchial area, and from its position becomes the proximate cause of the decarbonizing dyspnoea. In major epilepsy—in some cases at least—there is seemingly no adequate compensatory vaso-dilation : the consequent tendency to rise of blood-pressure is so sudden or so widespread that there is demanded inhibition of cardiac action ; and this is the proximate cause of the cerebral anaemia and so of the decarbonizing general convulsions.

But compensatory cardiac variations are not limited to major epilepsy : they may occur, though inconspicuously, in migraine and asthma. Neither is compensatory vaso-dilation limited to migraine and asthma ; it may occur, though inconspicuously and necessarily to quite an inadequate extent, in major epilepsy. By such variations of compensation and by variations in the localization of the vaso-motor changes, we may account for the existence of 'hybrid' paroxysmal neuroses—of paroxysmal affections presenting the clinical features of any two or more of the typical named paroxysmal neuroses.

§ 912. In the efficiently acarbonizing paroxysmal neuroses in which cardiac inhibition plays no important part, the localized vaso-dilation compensatory of extensive vaso-constriction leads directly as a rule either to restriction of income or to increased katabolic expenditure. But it may occasionally happen, through the anatomical or pathological features of the tissue affected, that the localized vaso-dilation leads to increased expenditure by direct loss—to haemorrhage in short. The haemorrhage may occur after the clinical manifestations of the paroxysm have developed : so we have various ecchymoses, epistaxis and cerebral apoplexy complicating or aborting migraine, haemoptysis complicating or aborting asthma, and haematemesis complicating or aborting gastralgia. Or the haemorrhage may occur before the clinical manifestations of the paroxysm have had time to develop : so we have cases of recurrent epistaxis, haemoptysis, haematemesis, etc. In all cases, the humoral causation (hyperpyraemia), mechanism (vaso-motor), and result (acarbonization or partial acarbonization of the blood), are the same ; and all such are strictly

analogous in all these respects to the recurrent physiological process of menstruation. The uncomplicated paroxysmal neuroses, the paroxysmal neuroses complicated by haemorrhage, and the recurrent haemorrhages substitutive of the paroxysmal neuroses, are all more likely to occur when the physiological process of menstruation is impending or commencing, because it is probably at that time that the inter-menstrual carbonaceous accumulation attains its climax. They are still more likely to occur, and to occur with increased severity, when factors intervene to prevent the menstrual flow: the last-mentioned are then regarded—and correctly so, it seems to me—as instances of vicarious menstruation.

§ 913. It may happen, however, that the organism affected with hyperpyraemia lacks for unknown reasons the capacity to institute pathological acarbonization through the vaso-motor mechanism, with or without the co-operation of the cardio-inhibitory mechanism; or it may be that the acarbonization so achieved is inadequate or ultimately becomes inadequate. Nevertheless the organism so circumstanced has quite possibly still left many pathological capacities upon which to fall back for acarbonization.

We have seen reasons for believing that concurrently with, and as a result of, the primary carbonaceous accumulation (hyperpyraemia), there tends to occur a secondary accumulation of uric acid in the blood by retention. Upon the supervention of adequate acarbonization of any kind, such retained uric acid is released and discharged by the ordinary renal outlet. On the other hand, in the continued default of adequate acarbonization, pathological as well as physiological, the secondary uric acid accumulation tends to increase; and this may continue until ultimately the accumulation becomes, so to speak, intolerable to the organism. In these circumstances, there will be an overflow of uric acid into the extra-vascular tissues, the exact site of which overflow will be determined by factors concerning which we have but little knowledge. So there may arise an attack of acute gouty pyrexia which, by virtue of the increased katabolic expenditure and diminished income involved, will effectually disperse the primary hyperpyraemia and the secondary uricaemia. Thus acute gout is a pyrexial acarbonizing process, the factors of which may be arranged in the order of their operation as

under :—Hyperpyraemia, uricaemia, uratosis, and articular inflammation.

In gout, the recurrent acarbonizing paroxysms depend almost exclusively, so far as we can see, upon internal factors : as with some of the paroxysmal neuroses, the organism seems to be utilizing almost solely its personal pathological capacities. The same is true possibly of other acarbonizing processes, such as some recurrent pyrexias, and even of acute rheumatism. But in other cases, it would seem, external or environing factors are essential for the development of pathological acarbonization, recurrent or continuous : such factors may be mechanical, thermal, microbic, or other, as in hay-asthma, some recurrent catarrhs, and some erysipelatoid attacks, possibly in tuberculosis. In such cases, we may suppose that hyperpyraemia constitutes an essential part of the predisposition ; and we may imagine that the organism is utilizing its pathological opportunities in addition to its pathological capacities.

§ 914. Probably, however, the distinction between processes which depend upon unassisted personal capacities and processes which require the co-operation of environing factors is more apparent than real ; for it is impossible to exclude the co-operation of environing factors in any case, though it may be that such operate indirectly and are inconspicuous.

The pathological acarbonizing processes so far considered depend upon exaggerations or modifications of physiological capacities, with or without the co-operation of external factors. But it would further seem that pathological acarbonization may depend upon the breakdown or loss of a physiological capacity. The so-called idiopathic haemorrhages, isolated or recurrent, which we have argued depend upon vaso-motor action and may replace the commoner means of vaso-motor acarbonization, may perhaps be regarded to some extent in this light ; and so almost certainly may glycosuria, one of the essential factors of which seems to be the loss or acquired inadequacy of the glycogenic function of the liver.

Finally, we may perhaps imagine that pathological acarbonization depends upon the acquirement by the organism of a new pathological capacity, as in the malignant anabolism of cancer and other tumours. It is, however, at least equally probable that malignant tumour-formation depends upon the loss of a capacity—an inhibitory capacity which in normal life

restrains within physiological limits the anabolic tendencies of certain groups of cells. This, however, is of course mere speculation.

§ 915. While fully recognizing the humoral condition of hyperpyraemia as the primary factor of many pathological acarbonizing processes, we must admit that in most cases, the operation of numerous secondary factors, intrinsic, extrinsic, or both, is no less essential. Such secondary factors operate for the most part by rendering facile the development of some particular form of pathological acarbonization. Thus in the presence of hyperpyraemia they determine the form of pathological acarbonization. But further than this, they may render some one form of pathological acarbonization so morbidly facile as to determine the recurrence of this process in the presence of a pyraemic condition which would otherwise be physiological. The secondary factors are thus responsible for 'pathological prepotency,' a state of the organism which implies that the pathological acarbonizing process has usurped a portion of the duties of the physiological acarbonizing processes. Thus the secondary factors may be regarded as determining a 'relative hyperpyraemia.' In such cases, it may of course fairly be argued that the factors which are here regarded as secondary should more properly be regarded as primary. The argument would have to be admitted in many cases; and it is certain that very often the secondary factors offer the most salient point for therapeutic attack.

Amongst the secondary factors personal to the organism is one which is extremely important, namely, the exaggerated tendency to fresh attacks which is acquired through previous attacks, the 'memory of the body' as Hunter termed it. This factor, in all cases adversely operative from a therapeutic standpoint, is of far graver importance in some pathological acarbonizing processes than in others. Its importance seems to rise as the features of the process become prominently nervous, and to reach its climax in epilepsy, in which disease it seems to constitute the chief bar to successful treatment.

§ 916. Failing adequate pathological acarbonization, recurrent and other, as well as adequate physiological acarbonization, hyperpyraemia will remain as a more or less chronic or unrelieved humoral condition. Sometimes, it would seem, unrelieved hyperpyraemia results from an originally inherent

inability on the part of the organism to institute pathological acarbonization. But more commonly, I think, recurrent pathological acarbonizing processes of one or more varieties have been in prolonged operation and have gradually become worn out and inadequate; and then the loss of such pathological functions must be regarded as responsible for the continuance of unrelieved hyperpyraemia. Hence, just as physiological acarbonization tends to graduate in many cases into pathological acarbonization, so the pathological acarbonizing processes (a term synonymous, for the most part, with the manifestations of recurrent hyperpyraemia) tend to graduate into the manifestations of unrelieved hyperpyraemia; and we may regard the latter usually as ineffectual attempts at the former.

Conformably, we find that the anteceding pathological acarbonizing processes determine for the most part the manifestations of the eventual unrelieved hyperpyraemia: that the latter are in many cases modifications of the former, differing from them in degree and duration rather than in kind; and this whether we view them from a clinical standpoint or from the standpoint of their pathological mechanism. Thus recurrent glycogenic distension of the liver occurring as a part of a bilious, migrainous, gastralgic, or other attack, headaches associated with anorexia (typical migraine), paroxysmal asthma especially if associated with severe obstructive dyspnoea, major epilepsy, acute gout, etc.—all these, since they are more or less efficient acarbonizing processes, are manifestations of recurrent hyperpyraemia. On the other hand, chronic glycogenic distension of the liver, headaches unassociated with digestive symptoms (various neuralgias), chronic bronchial catarrh or chronic bronchitis, minor epilepsy, asthenic and chronic articular gout, etc.,—these, since they are inadequate as acarbonizing processes, are manifestations of unrelieved hyperpyraemia.

§ 917. In the mechanism of the large and well-defined class of pathological acarbonizing processes termed paroxysmal neuroses, vaso-constriction occupying extensive areas constitutes an important, if not always an essential, item. Such vaso-constriction, unless adequately compensated, causes high blood-pressure, which must accordingly be regarded as a manifestation of hyperpyraemia. But the paroxysm may be an

efficient acarbonizing process: hence the high blood-pressure may be recurrent merely and subside with the attack. In hyperpyraemia unrelieved by recurrent acarbonization, there may also be extensive vaso-constriction; and this, if uncompensated or inadequately compensated, causes high blood-pressure. But in this case the vascular condition will be more or less persistent: hence persistent high blood-pressure may be an important manifestation of unrelieved hyperpyraemia.

The view that the manifestations of unrelieved hyperpyraemia are in many cases but modifications of the pathological acarbonizing processes, is capable of considerable, if not indefinite, extension. In many of the latter, especially perhaps in migraine and epilepsy, cases are not infrequent in which various perversions of sensation, common and special, and various nervous and psychical symptoms are prominent. Consistently, in some of the manifestations of unrelieved hyperpyraemia, various modifications of common and special sensation, nervous and psychical disorders, constitute the foreground of the clinical picture. So we may have, as manifestations of unrelieved hyperpyraemia, various hyperesthesiae, hypaesthesiae and paraesthesiae, vertigo, amblyopia, tinnitus, perversions of taste and smell, and nervous and psychical disorders, from depression or excitement up to overt insanity of almost any clinical type.

§ 918. The general tendency of hyperpyraemia is towards impairment of function and early structural degeneration: to these results it conduces through factors which are at present innumerable. It is possible that the overloaded condition of the blood, constituting hyperpyraemia, is itself a direct factor in malnutrition of the tissues generally; but the influence of this factor can hardly be estimated at present. It is, however, a relatively simple task to form some conception of the degenerative influence exerted by the recurrence of the pathological acarbonizing processes which are so frequently incited by hyperpyraemia and by the continuance of the results of unrelieved hyperpyraemia which so frequently succeeds the cessation, or acquired inadequacy, of the recurrent pathological acarbonizing processes.

Physiological acarbonization must be regarded as acarbonization which is accurately adapted to the needs of the organism: hence its work is performed efficiently, as a rule, and

economically. Pathological acarbonization, on the other hand, may be regarded as acarbonization which is inaccurately adapted to the needs of the organism: hence it may be inefficient and it is not rarely an extremely expensive process. Its expensiveness is visible in the functional and structural impairments which palpably succeed in many cases its prolonged recurrence. These impairments are extremely diverse; and their nature and localization depend, as we should expect, largely upon the nature of the acarbonizing process and upon the tissues and organs involved therein.

Thus in those processes which operate through a pathological degree of distension of the liver by glycogen, this organ may suffer perhaps in many complex ways, both as regards its functions, including the glycogenic function, and as regards the physiological structure of its tissues. The secondary mechanical congestion of the alimentary mucosae involved in the glycogenic distension of the liver may lead to various functional and structural disorders of the stomach, of the small and large intestines, and of the contained and adjoining glands for the manufacture of the digestive and mucous fluids. The exaggerated or perverted vaso-motor action common to the paroxysmal neuroses is itself fraught with pathological consequences, not only to the vessels immediately involved but to the heart, which may be ultimately strained, and probably to the tissues and organs which are under or over supplied with blood. The widespread recurrent vaso-constriction probably involves a certain degree of hypertrophy with subsequent degeneration of the media. The more or less compensatory vaso-dilation, which is so variously distributed in the different paroxysmal neuroses, leads to intra-vascular strain in the vessels involved, and this strain may eventuate diversely. It may eventuate in haemorrhage which may prove salutary, immaterial, serious or even fatal. Thus the cranial vaso-dilation of migraine may lead to a salutary epistaxis, an immaterial ecchymosis, a serious hemiplegia, or a fatal apoplexy. More commonly the intra-vascular strain of vaso-dilation is not relieved by haemorrhage, but continues more or less throughout the paroxysm. Such more prolonged recurrent strain demands and receives the added resisting power which is conferred by hyperplastic processes in the intima and

probably other tunics of the vessel walls ; but here subsequently degenerative succeed to the reparative processes.

The injurious influence of the recurrent vaso-dilation of the paroxysmal neuroses is not, however, restricted to the tissues of the vessel walls, even when haemorrhage does not result. Vaso-dilation leads to vascular distension of the supplied capillary area, and this in some cases to swelling of the enclosing tissues. Such swelling in the bronchioles constitutes the evanescent obstruction to respiration responsible for the asthmatic paroxysm ; but the frequent recurrence, still more the protracted continuance, of the swelling is apt to be followed by bronchitis and by swelling of the bronchial mucosae of a more permanent nature. So there may develop a permanent obstruction to respiration demanding and receiving the more or less permanent distension of the chest so commonly observed in old asthmatics. And such changes are probably often steps in the direction of emphysema, of the succeeding cardiac dilation, and of the still later succeeding ' nutmeg ' degeneration of the liver.

Coronary vaso-dilation is essential whenever the heart is called upon to overcome any unusual resistance ; and it seems probable that the exaggerated coronary vaso-dilation of angina, which is demanded by the exaggerated peripheral resistance of the paroxysm, is conservative in a sense. Yet there can be little doubt that the paroxysm is incidentally damaging : for serious cardiac weakness not rarely, fatal syncope occasionally, has followed early attacks. At any rate, the prolonged recurrence of coronary vaso-dilation, whether manifested in anginal seizures or not, would tend to cause sclerotic or atheromatous, and later obliterative, changes in the vessels ; and such, though in the first place reparative or adapted to increase resisting power, would end by restricting the necessary blood-supply, so hampering the heart in its struggle to overcome the peripheral resistance in the circulation.

Probably a parallel procession of changes, primarily reparative and salutary, ultimately degenerative and deleterious, might be traced in connexion with gastralgic and other paroxysms which depend for their acarbonizing influence proximately upon vaso-dilation.

In some cases of major epilepsy, vaso-dilation is replaced by cardiac inhibition, and the resulting cerebral anaemia becomes the instrument of the decarbonizing seizure. Such vicarious

use of the brain, however, leads almost inevitably in the long run to disordered cerebral function and consequent progressive mental failure; and such functional deterioration depends probably upon structural degeneration, if not macroscopic or microscopic, then molecular. Concurrently, perhaps, the vascular stases implied in each of such fits may damage the remaining portions of the nervous system and the remaining systems of the organism.

Finally, the exaggerated or unphysiological fluctuations of uricaemia and uric-acid excretion involved in hyperpyraemia and subsequent pathological acarbonization respectively, may be the proximate factors of damage and ultimate degeneration. The acute gouty paroxysm depends upon the secondary uric-acid factor; and every paroxysm probably leaves behind it some degree of articular impairment, though this may be imperceptible with early attacks. Also it seems probable that some cases of renal degeneration and some of uro-lithiasis and calculus depend to some extent upon the uric-acid complication in the pathological acarbonizing processes.

§ 919. Many of the factors which, in the paroxysmal neuroses and other pathological acarbonizing processes, conduce to damage and degeneration continue in operation after the development of unrelieved hyperpyraemia. Then, however, they are prone to be in many cases even more potent for harm, because less intermittent or remittent. Any malnutritional results depending directly on recurrent hyperpyraemia will naturally be exaggerated under continuous or unrelieved hyperpyraemia. The more or less chronic glyeogenic distension of the liver associated with conditions such as some cases of chronic biliaryness and some cases of tropical liver, will have a more injurious influence on the organ than the recurrent glycogenic distension associated with recurrent biliary attacks, etc. The continuous vaso-constriction in wide areas responsible for persistent high blood-pressure will lead more surely to hypertrophy of the arterial media with its subsequent degeneration, and to hypertrophy of the heart with its subsequent dilation, than will the merely recurrent vaso-constriction of the paroxysmal neuroses, etc. The continuous bronchial vaso-dilation associated with some chronic bronchitic conditions will tend more persistently, and therefore probably more effectually, than the recurrent vaso-dilation of asthma to cause

permanent distension of the chest, emphysema, cardiac and hepatic disorganization. The persistently exaggerated intra-vascular strain of the coronary arteries implied in persistent high blood-pressure will probably be a more potent factor in arterio-sclerosis or atheroma of these vessels than the recurrent strain involved in the recurrent peripheral obstruction of anginal paroxysms. And finally, the unrelieved or inadequately relieved uricaemia associated with such manifestations of unrelieved hyperpyraemia as chronic articular, and some forms of chronic abarticular, gout, will without doubt conduce to renal cirrhosis and degeneration, more certainly and more rapidly than will the recurrently relieved uricaemia of acute articular gout, and the still more frequently relieved uricaemia of the efficiently acarbonizing paroxysmal neuroses which depend upon hyperpyraemia.

§ 920. All the pathological factors which conduce to early degeneration may be regarded as exaggerations or modifications of those physiological factors which, even under the most favourable conditions, lead eventually to purely senile degeneration. Thus hyperpyraemia is perhaps in most cases but an exaggeration of the physiological high pyraemia which is normally recurrent: pathological distension of the liver by glycogen and the mechanical stases so brought about in the circulation of the alimentary mucosae are represented in purely physiological life by minor grades of the same conditions: the complex combinations of vaso-constriction and vaso-dilation found in the paroxysmal neuroses occur physiologically in the shifting of functional activity from organ to organ and tissue to tissue: persistent pathological high blood-pressure is but an exaggeration of physiological vascular tone: pathological differs from physiological cardio-inhibitory action in degree only; while the marked variations in the retention and excretion of uric acid associated with pathological hyperpyraemia and pathological acarbonization occur less conspicuously under the fluctuations of physiological pyraemia which are due to the intermittence of the food supply, and to other conditions inseparable from civilized life.

In general terms, hyperpyraemia demands the reinforcement of economical physiological action by expensive pathological action, and leads, consequently, to the development of vicarious function: thus it exaggerates the wear and tear of

life and conduces to premature senility. Consistently with this deductive conclusion, it has often been observed that many of the morbid appearances presented by the degenerative diseases which we are ascribing to hyperpyraemia conform generally with the appearances found after physiological death in extreme old age. Such considerations clearly encourage the hope that when, through the study of physiology generally and through the study of the physiological peculiarities of the individual, we have learned how to *stoke and repair scientifically each individual human engine*, and when consequently the organism is relieved from the frequent necessity of compensating, by means of various more or less effectual but always expensive devices, for the strain involved in a haphazard food supply—a food supply, that is, which is not fully dictated by either instinct or reason,—the average duration of human life will be considerably extended.

THE CONSERVATIVE PRINCIPLE INVOLVED IN THE THEORY OF HYPERPYRAEMIA

§ 921. The conception of the conservative principle of disease—the view that many of the manifestations of disease ‘and of its methods are marked by a purpose, and that that purpose is beneficent’¹—has been held by philosophic physicians from the time of Hippocrates to the present day. Sydenham regarded ‘acute diseases, such as fevers and inflammations . . . as a wholesome conservative effort or reaction of the organism to meet the blow of some injurious influence operating from without ; in this he followed the Hippocratic teaching closely, as well as the Hippocratic practice of watching and aiding the natural crisis. Chronic diseases, on the other hand, were a depraved state of the humours, mostly due to errors of diet and general manner of life, for which we ourselves were directly accountable. Hence his famous dictum :—‘Acutos dico, qui ut plurimum Deum habent authorem, sicut chronici ipsos nos.’²

But unanimity upon these questions does not obtain even now. On the one hand, many still dispute the tenability of the conception that acute diseases are conservative: this they regard as based upon no firmer foundation than that of the imagination. On the other hand, one physician has gone so

¹ Sir Frederick Treves in *Brit. Med. Journal*, October 18, 1902, p. 1197.

² *Encyclop. Brit.*, art. ‘Sydenham.’

far as to affirm that 'all disease is salutary.' The truth would appear as usual to occupy an intermediate position—a position such, for example, as is defined in the following pronouncement by Treves in his recent address at the University College, Liverpool.¹ 'The time has come when it would . . . appear that many of the so-called symptoms of disease are expressions of a natural effort towards cure, that they are not only not malign *in their intent*, but have for their end the ridding of the body of the very troubles which they are supposed to represent.' (Italics mine.)

Now the theory of hyperpyraemia implies a great extension of the conservative principle of disease. For it offers tangible grounds for including within the pale of this principle numerous affections always hitherto regarded as hopelessly excluded—affections like asthma and epilepsy, to take only two striking examples. But all such inclusions being freely admitted, we are still far indeed from the general conclusion that 'all disease is salutary'; for it seems certain that many conservative processes are more injurious to the organism than the conditions which they are adapted to disperse, and which indeed they not infrequently succeed in dispersing. Manifestly it has here become necessary to draw a sharp line of demarcation between the meaning of the terms 'salutary' and 'conservative': the latter at any rate urgently demands redefinition. Now it appears to me that we can most readily arrive at the true signification of this term through analogy.

§ 922. To this end, we may compare the human organization in its continual struggle for existence against more or less adverse conditions to an army in the field surrounded by hostile forces. The position of commander-in-chief is represented by the guiding forces of instinct and reason. Neither of these, however, is, according to this argument, in unfettered operation in the present stage of civilization: instinct is ceasing to be the perfect guide which it was in primitive man and which it still is in the lower animals in the wild state: reason, though on the up grade of, is yet low down in, evolutionary development. Hence the human organization may be considered to be in the position of a beleaguered army led by an incompetent commander-in-chief—by a commander-in-chief, that is to say, who is not fully conversant with the necessities

and capacities of the various portions of his command, and who lacks the power therefore to provide fully for the former and to utilize to the best advantage the latter.

In the military organization in these circumstances, the initiation of defensive action against some special danger threatening a portion of the army will often devolve upon a subordinate officer. I will assume that the independent defensive action so initiated is well conceived and completely successful against the immediate localized danger. Now the general results of such a success may vary widely. It may be that the position saved was vital to the whole army: in this case, the success of the defence will have meant the salvation of the whole army. But, on the other hand, there are numerous instances in military history in which the very success of such an independently initiated action has endangered, or even led to the ultimate defeat of, the whole army. The blame for the catastrophe in such cases cannot with any justice be laid upon the subordinate officer. Quite possibly his action was the only correct action from his view-point; but his field of vision was necessarily restricted to the interests of his own command; and the interests of his own command were unfortunately in conflict with the interests of the army at large. Manifestly, in such cases, the blame can only be justly laid upon the commander-in-chief. His field of vision should have included the whole army: he should have foreseen the disastrous results liable to follow such an isolated success, and should have provided in advance against the contingency.

So it would appear to be with the human organization. The various systems, organs, and tissues are largely endowed with the capacity to fight successfully and more or less independently against hostile conditions which threaten their integrity. Instinct operating under a stable environment largely diminishes the necessity for such independent hostilities or provides that such as are necessary shall be conducted economically, that is, with due regard to the interests of the whole organization. Defensive hostilities so conducted really cease to be instances of pathological action: they come practically within the domain of physiology. But instinct, as we have seen, is a waning force, and reason as yet an imperfect guide. Hence not infrequently it happens that defensive action undertaken by more or less independent portions

of the organism is anything but salutary to the whole organism: pathological action which is manifestly conservative, that is, salutary *in intent*, turns out to be disastrous in *result*.

On the other hand, there are, of course, numerous examples in which pathological action leads to results which are to all appearance completely favourable. And between these two extremes lies an unbroken series of intermediate results. The theory of hyperpyraemia points to a long series of examples: pathological acarbonization of many varieties may eventuate fatally, in progressive disease or in rapid and complete convalescence. Even in the last case, however, pathological action can only be regarded as an imperfect substitute for physiological action.

§ 923. All physiological action is conservative. But it is much more: it is conservative in the most economical way. Adapted as it is to a necessary end, it attains this end with the minimum of wear and tear, that is with the minimum of collateral damage: it is *wholly salutary both in intent and in result*. It may be too much to say at present that all pathological action is conservative, salutary in intent, that is to say. But even if this could be maintained, it is clear that pathological action would still be conservative in widely different degrees. And between the purely salutary physiological action and the most fatal form of conservative pathological action, there would still be an infinite series of intermediate gradations: physiology would still graduate into pathology.

Might we not regard physiological action as the ultimate outcome of natural selection, and the various forms of conservative pathological action as steps in the process? In the past there have been vast migrations of the various races of mankind, and the immigrants have necessarily been exposed to entirely new environments. It requires no effort to imagine that such alterations of environment might lead in many cases to increased carbonization, or decreased acarbonization, of the blood and so to hyperpyraemia. Slight variations of the individual would determine the form taken by the acarbonizing reinforcement so demanded. In some there might develop migrainous, asthmatic, or epileptic acarbonization: upon such there can be no doubt that the laws of natural and sexual selection would operate unfavourably. In others there might develop simple recurrent bilious attacks or still more simple

recurrent slight anorexia, passing by insensible gradations into regulation of the nutritious income through quite physiological action of the hepatic glycogenic function: upon such the aforesaid laws would operate much less unfavourably, if unfavourably at all. In others again there might develop a slight tendency to corpulence or a mere increase of physical activity, combined with a general increase of nutrition and strength: the last, probably, would be the fittest of all and, therefore, the most likely to survive and multiply.

§ 924. In an observation of the varying twofold influence—now salutary, now malign—of conservative pathological action, we may, I think, find valid excuses for two seemingly conflicting plans of treatment, the *expectant* and the *symptomatic*. On the one hand, it is to be observed that many morbid affections not only convalesce spontaneously or cure themselves, so to speak, but not infrequently terminate a period of more or less prolonged indifferent health and initiate a period of mental and bodily comfort and vigour. The most obvious example is acute gout; and the logical conclusion from observation of the facts of this affection was long since drawn by Sydenham, who held that ‘to use any medicine for a time is a waste of labour,’—who thus advocated *expectant treatment*. On the other hand, it is to be observed that other morbid affections, or the same morbid affections in other persons or on other occasions (though this rarely applies to acute gout), are apt to terminate fatally or in marked deterioration of the general health. The logical conclusion here is that treatment should be directed to cut short the disorder or, failing this, to modify the severity of its manifestations—to treat the disorder *symptomatically*.

Now a clear appreciation of the full meaning of the term ‘conservative’ as applied to hyperpyraemic affections, is of great importance in the practical therapeutics of declared disease—in the curative, as distinguished from the prophylactic, treatment of the disease. For it will tend to the differentiation of those features in the pathological process which are essential or salutary from those which are incidental and merely deleterious and pain-giving or dangerous. We shall thus run less risk of checking by active interference the salutary action of the former, while controlling them within the limits of safety; and we shall have a free hand in suppressing the latter. We shall thus greatly increase the chance of assisting Nature

and at the same time of relieving suffering: in general terms, we shall combine the advantages of the expectant and symptomatic plans, while avoiding the disadvantages of both. As concrete examples, we should refrain above all things from attempting any interference with the anorexia of migraine, or with the anorexia and pyrexia of acute gout; but it would be an unmixed gain were we able to relieve the pain of these affections without prejudice to the progress of the aforesaid salutary features.

GENERAL CONCLUSIONS AND CONCLUDING REMARKS

§ 925. A study of the theory of hyperpyraemia tends to the inevitable conclusion that a near approach to uniformity in the composition of the blood, quantitative as well as qualitative, is a dominant necessity of the organism. The provisions against a *deficiency* of material, nitrogenous and carbonaceous, seem adequate, though they endure for a time only. In the absence of fresh income from the alimentary canal, the blood is replenished from the tissues, and the amount withdrawn therefrom is in accordance with, but probably never exceeds, the demand. But the provisions against an *excess* of material in the blood are less simple. The *income*, both nitrogenous and carbonaceous, from the alimentary canal is regulated to some extent by the glycogenic function of the liver, that is by the capacity possessed by this organ when distended for retarding the functions of digestion and absorption. The *output or excretion* also is regulated by the organism, but far more accurately in the case of nitrogenous than of carbonaceous material. Nitrogenous excretion is for the most part automatic—it depends upon supply, that is to say. Carbonaceous excretion, though depending within certain narrow limits upon supply and therefore in so far automatic, is governed for the most part by the exercise of function. Hence doubtless the elaborate provisions for the extra-vascular storage of carbonaceous material,—storage provisions which, so far as can be seen, are hardly existent for nitrogenous material.

Were the storage provisions for carbonaceous material invariably adequate, as we are apt to assume, it is clear that hyperpyraemia could never arise. But these also depend

upon function (anabolism), and this not infrequently may be conspicuously deficient. Hereupon arises the necessity for the intervention of pathological functions, the pathological acarbonizing processes: these are examples of conservative disease. Through the instrumentality of these pathological functions, the uniformity of the blood may be maintained for longer or shorter periods, with more or less inconvenience to the individual and damage to the organism. But such pathological functions are beyond the capacity of some organisms, or having arisen, they may ultimately languish and fail. In either case, there will remain a state of more or less unrelieved hyperpyraemia; and this in turn will be succeeded by a further series of pathological phenomena, all more or less conservative and all more or less damaging.

§ 926. Thus it is mainly the carbonaceous, and not the nitrogenous, contents of the blood which tend to vary and of which the variations are so important a primary cause of pathological action, presenting widely different clinical features.

Subordinate to, and in great part dependent on, the maintenance of a uniform pyraemic condition, is the maintenance of a uniform mean in the general or aortic blood-pressure. Uniformity in this respect is maintained through the instrumentality of the vaso-motor mechanism, supplemented, when occasion demands, by the cardio-inhibitory and the accelerator or augmentor mechanisms. Usually the vascular and cardiac variations so brought about are restrained within physiological limits; but not infrequently they overstep these limits and enter the domain of pathology. In the struggle to maintain pyraemic and blood-pressure uniformity, the organism may use most of its capacities, physiological and pathological, and not a few of the opportunities afforded by its environment. It may undertake and execute the most complicated manœuvres; and in doing so it freely accepts enormous risks and not infrequently pays an exorbitant price.

Thus we are led once more to adopt a fundamentally humoral view of disease, and we may regard the medulla oblongata, containing as it does the chief vaso-motor, cardio-inhibitory, and accelerator centres, as a 'conning-tower,' wherein are governed and correlated the various vascular and cardiac mechanisms. But such a view is by no means exclusively humoral. The humoral is but one factor in pathology. It is

essential probably in all cases, and in the majority it is probably the most important from a therapeutic standpoint. But many functional factors which for convenience have been termed secondary are no less essential to the determination of pathological action. And these, since they often exhibit the greater or even the sole departure from what we are accustomed to regard as the normal, will constitute in such cases the more important indication for treatment. Not even here, however—that is, in cases which exhibit pathological prepotency—can the humoral factor be omitted from consideration. And its full recognition will frequently make the difference between unsuccessful and successful therapeutics.

Humoral factors, though perhaps in less definite form than is implied in the term 'hyperpyraemia,' are, I feel confident, daily receiving fuller recognition from scientists and clinicians who take a wide and comprehensive view of pathological problems. Thus Chittenden says :¹—'Any excess of food over and above what is needed to make good the loss incidental to life and daily activity is just so much of an incubus which is bound to detract from the smooth running of the machinery and to diminish the fitness of the body for performing its normal functions.'

§ 927. The ultimate and far-reaching results of a dependence upon pathological as distinguished from physiological function hardly call for much insistence. As Chittenden says :²—'A proper physiological condition begets a moral, mental, and physical fitness which cannot be attained in any other way. Further, it must be remembered that lack of a proper physiological condition of the body is more broadly responsible for moral, social, mental, and physical ills, than any other factor that can be named. Poverty and vice on ultimate analysis may often be traced to a perversion of nutrition. A healthy state of the body is a necessary condition of mental and moral vigour, as well as of physical strength.'

No doubt it will be contended that there is no direct evidence in support of the theory of hyperpyraemia,—that the view which assumes that carbonaceous material absorbed from the alimentary canal can accumulate in the blood to an ultra-physiological degree is a mere hypothesis lacking any sort of

¹ 'Physiological Economy in Nutrition,' *Popular Science Monthly*, June 1903,
p. 123.
² *Ib.*

direct chemical demonstration. The contention must be freely admitted. The theory of hyperpyraemia is supported by no direct evidence, but the indirect or circumstantial evidence in its favour seems to me irresistible. And it may fairly be asked :— Does not an hypothesis which is so widely consistent with recorded observations, which seems capable of illuminating so many of the dark places in physiology and pathology (biology, that is), and which leads so directly to successful practice, deserve careful examination from each and all of its encircling view-points, remote as well as proximate, before being cast aside as visionary ? And further, is not the amount of circumstantial evidence adduced in favour of the frequent occurrence of hyperpyraemia, coupled with the high *a priori* probability of such a condition, sufficient to throw the onus of disproof upon the opposition ? I submit both questions in all due humility.

§ 928. The practical difficulties in the way of a chemical demonstration, positive or negative, seem to me great. Our knowledge of the chemistry of physiological pyraemia is far from complete : the distinction between physiological pyraemia and pathological hyperpyraemia is probably quantitative in many cases rather than qualitative ; and the difference between the two is probably small in any case, non-existent in pathological prepotency. In addition to this many of the most conspicuous effects of hyperpyraemia are acarbonizing processes,—processes which disperse or diminish the humoral factors upon which they depend. The cases most likely to yield a positive result to chemical investigation would be (1) cases, such as acute recurrent gout, in which pathological prepotency can be excluded, and in which well-known premonitory symptoms show that an acarbonizing paroxysm is impending ; and (2) cases in which the manifestations of unrelieved hyperpyraemia, such as persistent high blood-pressure, are unmistakable. In both instances there would be uricaemia, a chemical condition which we have suggested may be an index of hyperpyraemia.

§ 929. The theory of hyperpyraemia, including the manifold modes of origin of this blood-state, its manifold manifestations, and its manifold ultimate results, seems to me entirely consonant with the views expressed by Jonathan Hutchinson in his Hunterian Lecture on the ‘Laws of Partnership in Disease.’¹

¹ *Brit. Med. Journal*, October 24, 1891.

Hutchinson animadverts upon the cramping effect upon knowledge of the application of arbitrarily defined single names to affections which are of ill-defined nature and which are not dependent on single causes. He protests against the arbitrary multiplication of separate diseases. Diseases should be regarded not as distinct species but as the outcomes of a varying intermixture of causal influence. The original causes of disease are but few, their combinations many, and their results varied.

No doubt, as it stands, the theory of hyperpyraemia is crude; nor perhaps is its stability at present above all suspicion, seeing that it is overburdened with speculations, underweighted with facts. Yet the former can be sifted and cleared of irrelevancy and inconsistency: the latter largely reinforced and reorganized. And it may, I think, be claimed that the theory is animated by a philosophical aim, since, as has been said, ‘the end of philosophy is the detection of law and unity in seeming discord and multiplicity.’

CHAPTER XXVI

§§ 930-958

Treatment of hyperpyraemic affections—Therapeutic measures which have been used in hyperpyraemia : venesection : purgation : emesis : setons : restriction of food : restriction of proteid : restriction of the carbonaceous intake : climate and exercise : drugs—Treatment of pathological prepotency—Treatment of the hyperpyraemia : diet : exercise and sleep : climate, external temperature and fresh air—Treatment of the uricaemia : suggestions as to the treatment of arthritic gout, preventive and other—Treatment of the individual—General conclusion from a practical standpoint.

§ 930. In this chapter, I shall consider only radical treatment, preventive and curative, as distinguished from symptomatic treatment, such as the means of relieving pain, dyspnoea, etc. The subject can only be treated in a very general way. The reader will, I think, obtain a more practical conception of the therapeutics of hyperpyraemia by studying the cases detailed in the appendix. But in the variations of detail demanded by different individual cases of hyperpyraemic disease, there is manifestly a wide scope for future investigation.

THERAPEUTIC MEASURES WHICH HAVE BEEN USED IN HYPERPYRAEMIA

§ 931. It seems to be a rule, to which there are only a few quite recent exceptions (for example the antitoxin treatment of diphtheria), that the successful treatment of disease should be arrived at in the first instance empirically and that the rationale of such treatment should be discovered subsequently. The treatment of hyperpyraemic affections constitutes no exception to this rule. Most of the methods by which hyperpyraemia may be relieved and the manifestations of hyperpyraemia dispersed have been used in practice for generations. They have been arrived at from observation or suggested by hypotheses

long since exploded; and a study of the history of such methods can hardly fail to be of high scientific interest as well as of considerable practical advantage. Here reference may be made to a few of the more important.

§ 932. VENESECTION.—Venesection was at one time regarded as the panacea for most morbid conditions; but it was used not only as a curative agent in declared disease but also periodically as a prophylactic. We have seen that venesection is capable of reducing exalted blood-pressure both directly and indirectly. It also acts as an immediate decarbonizing agent, and it is probably by virtue of this action that it indirectly affects the blood-pressure. Repeated resort to venesection, however, is apt to cause anaemia: thus combustion is retarded and hyperpyraemia, with its original or new manifestations, may be reinduced. Observation of such results doubtless led to the abandonment of repeated venesection in the first place, and later of venesection altogether. Its total abandonment seems to me to have been an over-reaction.

§ 933. PURGATION.—Systematic purging has frequently been exalted into a system of treatment. The periodic administration of blue pill followed by a black draught was prescribed, with at least temporary success, for a multitude of clinical conditions: many of these may now be ascribed to hyperpyraemia, or to the glycogenic distension of the liver or pathological vaso-motor action, associated with hyperpyraemia. A patient subjected to a course of such eliminative treatment was said to have been ‘abernethianized’ in honour of one of the chief supporters of the method. The plan is still indulged in extensively, perhaps more often by the patient on his own initiative than on the advice of the modern physician. Many sufferers from migraine, asthma, etc., continue to purge themselves at more or less frequent intervals; and all argument fails to shake their belief in the expediency of the practice. We have seen that purgation, more especially by mercurials which operate mainly upon the upper portion of the smaller bowel, tends to reduce hyperpyraemia through restriction of the carbonaceous income; and that it relieves also the portal congestion so often associated with hyperpyraemia. That the salutary influence of purgation, which is in most of the cases under consideration indubitable, is evanescent, is of course clearly explicable by the temporary nature of the acarbonization attained.

§ 934. EMESIS.—The routine administration of emetics at the commencement of many diseases used to be a favourite practice ; and it was thought to have the power to cut short the affection in some cases. By its means the stomach is emptied of material which might have undergone more or less absorption : the flow of bile from the gall-bladder and gall-ducts is accelerated ; and through the sensation of nausea induced, fresh intake is for a time precluded. Nausea and vomiting also have an abortive influence upon some impending neurosal paroxysms through the sudden reduction of blood-pressure thereby induced.

§ 935. SETONS.—Setons, usually inserted into the back of the neck, were formerly employed almost as frequently as bleeding, and in almost as many diverse morbid conditions. Their salutary influence upon many of the affections here ascribed to hyperpyraemia is too conspicuous to be overlooked. Such in the old days was probably explained on some theory of counter-irritation ; but there can be little doubt that they act through pyrexial acarbonization. Consequently, we may regard the treatment by seton as an imitation of one of Nature's methods of relief or cure ; for, as we have repeatedly seen, the majority of hyperpyraemic affections (while still uncomplicated) may be dispersed temporarily—now and then permanently—by pyrexia, incidental or other.

In a similar light we may regard the treatment by venesection, purgation, and emetics. Haemorrhage, diarrhoea, and vomiting may all occur in hyperpyraemic affections ; and their influence is for the most part salutary, sometimes even abortive.

§ 936. RESTRICTION OF FOOD.—The treatment of disease by the withdrawal or restriction of food may also be regarded as an imitation of Nature—of the salutary anorexia which is so important an instrument of the *vis medicatrix naturae*. This plan has found many able advocates, more especially of recent years. George S. Keith, in two charming little monographs,¹ has set forth earnestly and temperately his convictions on the subject of dietetic treatment, preventive and curative. Taking an unusually broad view of the conservative principle of disease, he has a profound respect for symptoms, above all for the symptom of anorexia, which he regards as almost invariably

¹ *Plea for a Simpler Life; Fads of an Old Physician.*

salutary, in effect as well as in intent ; and he trusts almost entirely to the operation of the *vis medicatrix naturae*. He quotes with approval the Russian skim-milk cure. Regarding many diseases as manœuvres on the part of the organism to disperse accumulations resulting from a continued surplus of food, he advises as the rule of life extreme temperance in food and almost total abstinence from alcohol. Meat, especially beef, he considers the most generally injurious form of food.

Edward Hooker Dewey¹ holds almost identical principles ; but his practice differs somewhat. He entertains an even greater respect for anorexia and systematically withholds all food in all cases of disease until the unmistakable reappearance of natural hunger. As a rule of life, he lays stress upon the total omission of breakfast. He draws no distinctions between the different kinds of food-stuffs ; but those who have partaken of the ordinary American breakfast will have no difficulty in realizing that the omission of this meal involves a large reduction of the carbonaceous intake. Dewey himself says :²—‘The American breakfast is gluttony.’

A. Rabagliati, conforming completely to the conservative view that disease is frequently an attempt on the part of the organism to get rid of material resulting from an excessive intake of food, advises extreme moderation in eating. His practice is to cut down the number, as well as the size, of meals : not infrequently he prescribes abstention. In his last work,³ he draws little distinction between nitrogenous and carbonaceous food-stuffs ; but in a previous monograph⁴ he ascribed the source of the morbiferous accumulation especially to the carbonaceous food-stuffs.

It is probable that the recent empirically initiated practice of precluding salt in the dietetics of epilepsy acts favourably through indirectly diminishing the carbon contents of the blood, both by restricting the intake and retarding digestion and absorption.

§ 937. RESTRICTION OF PROTEID.—Many dietetic systems depend essentially on restriction of the proteid intake. Such constitutes to my mind the only tenable scientific excuse for the various forms of vegetarianism and modified vegetarianism,

¹ *The True Science of Living*, Henry Bill Publishing Company.

² *A New Era for Women*, 1896, p. 292.

³ *Aphorisms, Definitions, Reflexions, and Paradoxes*, 1901.

⁴ *Air, Food, and Exercises*, 1898.

although it is true that the hypotheses upon which these systems are based are numerous and varied. Haig, on the hypothesis that a great number of common affections depend upon the circulation of uric acid in the blood, and that most of the uric acid comes from the ingestion of certain nitrogenous food-stuffs, prescribes a diet the main object of which is to preclude the introduction of uric acid-forming material. Lauder Brunton, on the hypothesis that periodic headaches depend upon the formation of toxins in such quantity that they override the 'sentinel' action of the liver and so obtain access to the systemic circulation, cuts down nitrogenous food-stuffs, the supposed source of such toxins. And Broadbent and others, on the hypothesis that persistent high blood-pressure depends upon the circulation of nitrogenous waste in the arterio-capillary system, reduce or cut off nitrogenous food-stuffs, the only source of such waste products.

Now it is clear that all these dietetic systems involve incidentally a material reduction of the proteid intake, and that such reduction may diminish the functions of digestion and absorption and thereby the inflow of carbonaceous material or fuel to the general circulation. To the diminished carbonization of the blood so attained we may ascribe the frequent success of these dietetic systems; but their equally frequent, perhaps more frequent, failures we may attribute to a concurrent diminution of acarbonization—a diminution which is proportionate, or more than proportionate, to the diminution of carbonization. Further, these divergent results must be set down to the intervention of unknown factors.

§ 938. RESTRICTION OF THE CARBONACEOUS INTAKE.—Another series of dietetic systems depends essentially upon restriction of the carbonaceous intake. Such are the system advocated by Cantani—restriction of carbohydrates: that of Bezly Thorne—modified diabetic diet: that which is pursued at Carlsbad—a small, mainly proteid diet; and the Salisbury diet—lean beef, white of egg, and hot water. While some of these were initiated with a view to avoid the formation of toxic products through abnormal fermentations in the alimentary canal and perverted metabolism after absorption, most seem to have originated empirically through pure observation. In most of them the total carbonaceous intake, in all the carbohydrate intake, is largely cut down; and probably in all the intake of

proteid is to some extent increased. The salutary influence of all these dietetic systems is hardly explicable except upon the theory of hyperpyraemia, though quite likely the simplification of digestion and metabolism precludes excessive toxin-formation. At least it seems certain that the view under which paroxysmal disorders like migraine and asthma depend upon the passage through the blood of uric acid on its way towards renal excretion, is untenable, since all these systems almost of necessity increase the amount of uric acid so circulating.

§ 939. CLIMATE AND EXERCISE.—The salutary influence of cool or cold climates on those whose health has suffered from the prolonged heat of the tropics has probably always been recognized by the public as well as by the profession; and there can be no doubt that in many cases hyperpyraemic affections may be dispersed solely by reduction of the external temperature. But I do not know that any tangible hypothesis has been suggested to explain these results. Somewhat vaguely we speak of heat as relaxing or debilitating, of cold as bracing, stimulating, or invigorating; and I am inclined to think that when using these terms we have in mind mainly the appetite. On the theory of hyperpyraemia, the salutary influence of external cold depends primarily upon the increase in the rate of combustion, which involves more rapid decarbonization of the blood with diminution of glycogenic distension of the liver and portal obstruction. But we are by no means called upon to deny that climate operates favourably upon the organism in many other ways concurrently.

Physical exercise has always been regarded as one of the almost essential conditions of robust health. But, as in the case of climate, its fundamental mode of action seems to have been unappreciated. Hence probably, while exercise has been much insisted upon as a general prophylactic, it has not until recently been widely prescribed with definite immediate objects in already declared pathological conditions. Of late years, however, the marked influence of muscular exertion in reducing exalted blood-pressure has been widely noticed, with the result that exercises of various specialized forms, as well as general physical exercise, are rapidly coming into fashion as curative measures in various affections. Under the theory of hyperpyraemia, the influence of physical exercise upon blood-pressure

is only one manifestation—the vascular manifestation—of its general decarbonizing influence.

§ 940. DRUGS.—Innumerable drugs have been found of use in hyperpyraemic affections. Most of these are adapted to mitigate the discomfort or pain of existing paroxysms or to defer impending paroxysms. They act for the most part directly upon the nervous, neuro-vascular, or cardiac factors, and do not modify, except perhaps very indirectly, the humoral factor. Of such a nature are the opiates, bromides, various coal-tar derivatives, the nitrites, adrenalin, hot and cold applications, etc. These will not be further referred to here, since the indications for their use are fully dealt with by others more competent for the task. Moreover, they escape the scope of this chapter, which is to call attention to the ever-present necessity for facing the humoral factor. But the omission must not be taken to imply any slur upon the proved utility, nay in some cases the indispensability, of many of these drugs.

A few drugs, however, seem to stand upon a different plane : amongst these may be placed iron, iodide of potassium, arsenic, and thyroid extract. Now some, if not all, of these seem to exert, through their influence upon the blood and upon metabolism, an appreciable influence upon the humoral factor.

Many hyperpyraemic affections are associated with anaemia ; and there can be no doubt that in some of these the anaemia is causative through the retardation of combustion entailed by deficiency of oxygen-carrying haemoglobin. Anaemic headaches have long been recognized, and their treatment by full doses of iron is highly successful. Wharton Sinkler¹ advises a three or four months' course of iron, combined with arsenic, in the migraine of chlorotic women ; and James Stewart² points out that 'iron is an agent which not infrequently is called for in the treatment of chronic gout.'

Iodide of potassium has been used extensively, often with conspicuous benefit, in a great variety of hyperpyraemic affections, but I am unable to frame any single hypothesis which will cover the rationale of its action in all cases. It has been said to reduce blood-pressure : this again has been denied and reaffirmed. But in any case, a mere mechanical reduction of blood-pressure would hardly explain its action in all cases.

¹ *System of Therapeutics*, H. A. Hare, vol. iii. p. 381.

² *Ib.* vol. i. p. 996.

The multiplicity of the hyperpyraemic affections which it seems capable of relieving suggests that the drug has some acarbonizing influence; but if it has, the mechanism of such influence remains obscure.

In asthma, iodide of potassium is probably the most generally useful of all drugs: in a few cases, it has resulted in apparent cure without other treatment. It is beneficial in some cases of chronic bronchitis, pulmonary emphysema, arterio-sclerosis, and atheroma.¹ Ten grains taken at the commencement of acute coryza has been known to abort the attack.² William Pepper has found it useful in angina pectoris associated with arteriosclerosis:³ I have found it useful in some cases not so associated. It is recommended in chronic gout⁴ and in some cases of albuminuria;⁵ and in my experience, it has greatly benefited some cases of recurrent headache. Finally it is, I think, the most generally useful drug in many of the ill-defined cardiac and vascular symptoms of elderly people, such as palpitation, tachycardia, and irregularity—symptoms which it is the fashion to associate with uric acid, but which are all explicable on the theory of hyperpyraemia. George S. Keith, who is anything but enthusiastic as to the therapeutic value of drugs, says:⁶ ‘Iodide of potassium is an admirable remedy for eliminating some deleterious matters from the body. In syphilitic cases no one doubts its efficiency. I have used it infinitely more frequently in cases where—from over-feeding mostly—the system has got loaded up, and a peculiar sallow look and ill-health indicated some general derangement. In most of those cases aperients and tonics had been used often for a long period with the object of helping digestion. There was usually some lowness of spirits, or irritability, or both, and always a want of strength. If the iodide is used in this condition, the relief to the patient is often very remarkable, and if accompanied and followed by a fitting change of diet, it is usually permanent.’

Arsenic has held its own for long periods in the treatment of most of the affections here ascribed to hyperpyraemia. It is often beneficial in migraine whether associated or not with

¹ *Practical Therapeutics*, H. A. Hare, eighth edition, p. 240.

² *Ib.*

³ *System of Therapeutics*, H. A. Hare, vol. ii. p. 386.

⁴ *Gout and Goutiness*, Ewart, 1896, p. 43; also *Treatise on Gout*, Duckworth, 1890, p. 371.

⁵ *Gout and Goutiness*, Ewart, 1896, p. 437.

⁶ *Plea for a Simpler Life*, 1897, pp. 23, 24.

anaemia. Of the drugs useful in asthma, James T. Whittaker says :¹—‘ Next’ (after iodide of potassium) ‘ is arsenic, which should be given in gradually increasing doses up to the point of tolerance : then reduced and continued in smaller dosage over long periods of time. Arsenic has manifold testimony to its virtue. It was the remedy most relied upon by the older practitioners.’ Lauder Brunton says :²—‘ Arsenic has been used . . . in spasmodic nervous diseases such as angina pectoris . . . and epilepsy. . . . It is often serviceable in hay-fever. . . . It has been employed in chronic bronchitis . . . and in ordinary catarrh without febrile disturbance. It appears to be very useful in the commencement of phthisis.’ Hobart Amory Hare³ finds arsenic useful in atonic dyspepsia associated with chronic diarrhoea, a condition which in my experience is not infrequently due to portal congestion depending on the glyco-genic distension of hyperpyraemia. The same author gives it in diabetes,⁴ especially gouty diabetes ; and James Stewart says :⁵—‘ Arsenic is a useful agent in the anaemia and debilitated states attending gout. It has a marked influence over metabolism, and further it has a direct haematic action.’ Finally, arsenic is widely employed in rheumatoid arthritis and kindred affections.

What is the rationale of the beneficial influence of arsenic in all these cases ? Leslie Roberts says :⁶—‘ For some time Liebig’s hypothesis was generally accepted as true. . . . According to this hypothesis, arsenic arrested the vital operations of the cell by entering into combination with its protoplasm. As a result of this combination, an anti-putrefactive arsenio-albuminate was found which had the power of resisting decomposition. We now know that there is no truth in this hypothesis : it was abandoned even by Liebig himself. The truth is the reverse of this. The arsenic does not combine with the albumen : it does not arrest the processes of the cells, but incites to greater activity. This is entirely borne out by our clinical experience of arsenic.’ If arsenic arrested or even retarded the vital operations of the cell, we should expect its exhibition to be followed in some cases by an accentuation of

¹ *System of Therapeutics*, H. A. Hare, vol. ii. p. 533.

² *Pharmacology, Therapeutics, and Materia Medica*, 1885, p. 644.

³ *Practical Therapeutics*, eighth edition, p. 89.

⁴ *Ib.* p. 88.

⁵ *System of Therapeutics*, H. A. Hare, vol. i. p. 996.

⁶ *Brit. Med. Journal*, September 28, 1901, p. 862.

the manifestations of hyperpyraemia, such as is liable to occur after the exhibition of lead in gout ; and the favourable influence of arsenic in such cases would be inexplicable. But the newer hypothesis is entirely consistent with the clinical facts.

Thyroid extract has been used with success in many affections which, most probably, depend in some cases upon hyperpyraemia, or upon the causes or results of hyperpyraemia. Among such affections are obesity, psoriasis, scleroderma, acute mania and melancholia, puerperal and climacteric insanities, and some stuporous states with primary dementia (Hobart Amory Hare).¹ Thyroid extract, as elsewhere pointed out, increases the rate of combustion. Thus it would disperse hyperpyraemia or avert the necessity for rapid fat-formation. If these are its effects, the drug should be useful in a much longer list of affections. It has been found successful in at least one case of cancer (§ 707).

TREATMENT OF PATHOLOGICAL PREPOTENCY

§ 941. It was argued in Chapter XIII that in many cases some one form of pathological acarbonization (mainly neurosal) becomes so facile as to usurp a portion of the duties of physiological acarbonization : that such pathological prepotency results from the operation of a great variety of factors ; and that where such condition obtains, treatment to be successful must not be restricted to the humoral factor, but must include the abolition or modification of the factors, responsible for the pathological prepotency. Although pathological prepotency has occupied but a small space in this work, it is not to be inferred that the condition is correspondingly unimportant. On the contrary, pathological prepotency must be regarded in many cases as of greater importance from a therapeutic standpoint than the humoral factor ; and I do not doubt that volumes might be devoted to its elucidation. But the subject only touches on the scope of this work, the main object of which is, as already stated, to substantiate the existence of the humoral or pyraemic factor.

Accordingly, in the majority of the illustrative cases detailed in the appendix, the operation of many of those factors which experience has shown to be especially conducive to prepotency of the common neurosal acarbonizing processes, such as

¹ *Practical Therapeutics*, H. A. Hare, 1900, p. 395.

migraine, asthma, and epilepsy, has been as far as possible excluded. To this end, the cases were examined for ophthalmic, nasal, faucial, dental, and other morbid conditions; and, where such were discovered, they were usually removed or treated before the treatment of the humoral factor was undertaken. In fact, in some of the cases of migraine, recurrent headaches, and asthma, the patients had already been under treatment by ophthalmologists, dentists, or rhinologists for considerable periods. Of course it is self-evident that at least one of the great causes of pathological prepotency, namely, prolonged recurrence—‘the memory of the body’—is irremovable except by a prolonged period of freedom. And this factor is probably the chief bar to completely successful results from acarbonizing treatment in many cases.

The influence of the bromides in rendering epileptic fits less frequent and severe is undoubtedly exerted almost certainly upon some of the secondary or functional factors of the disease. Probably the drug modifies the exalted vaso-motor irritability or the extreme susceptibility to reflex action characteristic of epilepsy. If so, the bromides should be useful in many other vaso-motor affections.

TREATMENT OF THE HYPERPYRAEMIA

§ 942. Having excluded as far as possible factors which seem capable of causing pathological prepotency, the curative treatment of hyperpyraemic affections resolves itself in the main into the dispersion and prevention of hyperpyraemia.

In Chapter VII it was argued that hyperpyraemia results from a disproportion between the income to, and the expenditure by, the blood of carbonaceous material, whereby the former exceeds the latter. Hence the restoration of the balance will be the aim of treatment. But since the balance may have been disturbed in various ways in different cases, it is reasonable to suppose that the therapeutic measures directed to its restoration should vary in some degree conformably; and this supposition receives support from clinical experience.

In some cases the factor immediately responsible for hyperpyraemia seems beyond question. The best example, perhaps, is the hyperpyraemia which arises through the sudden accidental or climacteric suppression of the periodic haemor-

rhage of menstruation. In such cases the treatment which naturally suggests itself is the institution of measures calculated to re-establish the flow ; or, failing this result, the promotion of an adequate vicarious flow by venesection or some other form of bleeding. The latter procedure may be regarded as the closest possible imitation of the natural acarbonization which has failed ; and in the few cases in which I have seen it put into practice, the result has been quite satisfactory. Another good example is the hyperpyraemia which follows the sudden cessation of some habitual physical exercise. Here the ideal treatment is, of course, the reinstitution of the physical exercise. Or again, hyperpyraemia may be clearly due to an occasional or habitual intake of food, especially of highly carbonaceous food, which is manifestly in excess of the physiological acarbonizing capacities of most organisms. Here, dietetic regulation is the course which is plainly indicated. Thus in all cases, the error mainly responsible for hyperpyraemia, and therefore mainly demanding correction, may be an error of function or an error of supply.

It may happen, however, that the factor which seems clearly responsible for hyperpyraemia is irremovable. A sudden cessation of physical exercise may be due to accident which necessitates confinement to bed ; or a marked deficiency of the fat-forming capacity may be inherent or at any rate practically impossible to remedy. In such cases we can only succeed through substitutive acarbonizing measures. In the first of the above two examples, we should probably have to restrict the diet : in the second, we might restrict the diet, or increase physical exercise, or both.

But in perhaps the majority of cases the chief factor in the disturbance of balance between income and expenditure is inconspicuous : hyperpyraemia has arisen from a combination of factors, and it is impossible with justice to blame any one in particular. Here the most reasonable course seems to me to endeavour to restore the balance between income and expenditure by operating on both concurrently ; and it may often be advisable to do so in many ways.

As already stated, we may restrict the income to the blood (1) by weakening the functions of digestion and absorption, as by cutting down the proteid in an ordinary mixed diet, (2) by restricting the carbonaceous intake, as by simply reducing the

amount of food or cutting down the highly carbonaceous food-stuffs, or (3) by hastening the passage of the chyme over the absorbent intestinal mucosae, as by the administration of purgatives, especially mercurial purgatives: we may increase the expenditure (1) by increasing combustion, through increased proteid ingestion, increased physical exercise, increased exposure to cold (as by change of climate or cold bathing), increased oxygen supply (either by inhalation of the pure gas or by open-air treatment), the induction of pyrexia (by seton for example), or through the administration of some drugs (arsenic, iron, and thyroid extract for example), (2) by increasing anabolism, as by pregnancy or by measures adapted to increase the capacity for fat-formation (increase of proteid in some cases, perhaps arsenic), or (3) by promoting direct loss, as by venesection or other forms of bleeding. It is manifest that in the above list there is no single item which has any claim to novelty. The theory of hyperpyraemia provides us with no new instruments; but it enables us to use rationally instead of empirically, and therefore with vastly increased efficiency, all those with which we have been long provided.

The measures upon which I have mainly relied, in the majority of cases, are those in the above list which seem the most natural, namely, regulation of diet, exercise, and sleep, judicious exposure to cold, and the provision of an abundance of fresh air. Purgatives and other drugs have been used occasionally in exceptional cases: venesection, very rarely and then only in emergencies; while the seton has been reserved for cases in which other means were impossible, or had already failed.

Nevertheless, it may be that the induction of a mild septic pyrexia, as for example by the use of the seton, possesses therapeutic potentialities superior in many cases to those of the other acarbonizing measures referred to. So long as we remain ignorant of the chemistry of hyperpyraemia, so long must we continue to entertain the probability that this blood-state includes numerous chemical conditions. Conformably, we may entertain the view that the acarbonization induced by pyrexia is more nicely than other varieties of acarbonization adapted to the special chemical features of some hyperpyraemias. At any rate, I have on several occasions seen pyrexia succeed in dispersing hyperpyraemic manifestations

where diet and exercise had apparently failed. I say 'apparently' because most of my cases were consulting-room cases ; and it is never possible to be certain that treatment by diet and exercise has been rigidly carried out in such cases.

§ 943. DIET.—Three dietetic methods of treatment have been referred to, namely, restriction of food generally without regard to its nature, restriction of proteid, and restriction of the carbonaceous food-stuffs. I have already given *à priori* reasons for thinking that the last is generally preferable. Nevertheless, I have little doubt that all are capable of dispersing hyperpyraemia in different cases ; and it may well be that for each there are cases which are especially suitable. Hence I am anxious to avoid dogmatism in the selection ; and I shall confine myself mainly to a relation of my own experience.

Of the first method I have had hardly any experience. Of the second my experience has not been extensive ; but it has been sufficient to show that while it frequently fails to disperse the manifestations of hyperpyraemia, it often succeeds, when conscientiously carried out, in affecting prejudicially the general health and the physical and mental energy and activity : in more than one case, a distinctly appreciable degree of anaemia was ultimately induced. Of the last method, of which I have had an experience which extends over a considerable number of cases and over a period of more than six years, I feel myself now in a position to speak with more confidence. In combination with the other hygienic measures already referred to, it has given results which for rapidity and decisiveness seem to me unsurpassed ; while in not a few cases, it has succeeded in dispersing long-standing hyperpyraemic affections, without other change in the mode of life, and even in spite of the continuance of conditions which must be regarded as distinctly unhygienic.

§ 944. One object of this dietetic method is the amelioration, or the maintenance at a high level, of all those functions of the organism which make for a normal or physiological pyraemia. Amongst these are the carbonizing functions, namely digestion and absorption, the functions which regulate the carbonaceous income, such as the glycogenic function of the liver, and the decarbonizing functions, chief of which are combustion, fat-formation, and menstruation. A second object of this dietetic method is the graduation of the total

carbonaceous or fuel supply to the functional capacities of the organism for the time being.

The first object is attained by the administration under proper conditions of a sufficiency of digestible and assimilable proteid: the second, by careful and accurate dosage of the purely carbonaceous food-stuffs, the fats and carbohydrates, after making allowance for the carbonaceous contents of the proteid supply.

As regards quantities, I may say at once that I am unable to formulate definite rules. The quantity of proteid necessary for the maintenance of high functional activity seems to vary, perhaps widely, with the individual and with his habits, occupations, and conditions of life. Speaking generally, I am inclined to regard the quantity set down in standard dietaries as inadequate on the average—I am certain it is so for many individuals; while the amount which is habitually taken by some women—by those of the poorer classes in most countries, and by many of all classes in the tropics—is often manifestly inadequate. The same seems true of school-children over most parts of the civilized world, more especially of girls. Hence I am accustomed to increase the allowance of proteid, sometimes considerably, and I have done so with the less hesitation since, for the reasons already given, there seems little danger of damage from a moderate nitrogenous excess, *provided that carbonaceous excess is precluded*.

It is quite otherwise with the purely carbonaceous food-stuffs which constitute the main part of the fuel of the organism. Where, as in the dietetic method advocated, there is an ample supply, possibly an excess, of proteid, accurate regulation of the supply of fats and carbohydrates is absolutely essential. By what rules are we to gauge the carbonaceous supply?

§ 945. It is possible to estimate with some approach to accuracy the daily katabolic expenditure by the organism in calories: it is also possible to estimate in calories the fuel value of any given diet; and many attempts have been made to base a physiological diet upon the facts so elucidated. But all such attempts involve many assumptions which are not only unproved, but untenable. Amongst such assumptions seem to be the following: (1) that the whole of the digestible portion of the food necessarily undergoes digestion and absorption: (2) that the combustion of the organism is regulated solely

by the demand for force and heat production : (3) that any unoxidized carbonaceous material which remains after the demands of the organism for force and heat production have been satisfied is necessarily converted into, and stored within the tissues as, fat, glycogen, etc. ; and (4) that consequently the condition we have termed hyperpyraemia is impossible.

Against such assumptions it has been argued, (1) that digestion and absorption vary with many conditions, prominent amongst which are the amount of proteid contained in the diet and the regulative capacity of the liver : (2) that a part of the combustion of the organism depends upon the necessity for decarbonizing the blood : (3) that fat-formation depends, *inter alia*, upon a vital capacity of the nitrogenous tissues, which capacity varies with the individual and many conditions, and that deficiency of this capacity tends to throw extra decarbonizing work upon combustion ; and (4) that hyperpyraemia is not only a possible, but a frequent, condition.

Manifestly then if these arguments are valid—and I am acting throughout on that assumption—any attempt to regulate the carbonaceous intake by the output of carbonic acid (under the ordinary conditions of life) must be fallacious. For, in the first place, the intake so regulated may be inadequate, since a part of it may simply pass through the alimentary canal or undergo putrefactive decomposition ; and in the second, it may be excessive and lead to superfluous combustion.

§ 946. We can, I think, only regulate the carbonaceous intake by careful clinical experiment in each individual case. In the treatment of ordinary recurrent hyperpyraemic affections, such as periodic headaches of many kinds, asthma, and angina, I have been accustomed to feel my way somewhat in the following manner. I usually begin by placing the patient on a small mainly proteid diet, consisting, say, of 8 to 12 ounces of cooked lean meat or fish, with $1\frac{1}{2}$ ounce of bread or toast and a little butter : green non-starchy vegetables are admissible, also tea and coffee with a little milk, but no sugar. The enforcement of such a daily diet is, except in those who are extremely emaciated, almost of necessity accompanied by a daily loss of weight. This loss is carefully estimated by weighing every day or on alternate days : this gives some index of the addition to the carbonaceous supply which is required. By carefully adding to the amount of carbohydrates and fats,

preferably by very cautiously increasing the allowance of bread-foods, butter and milk, we arrive shortly at a diet under which the body-weight remains stationary. Carbon equilibrium is then being maintained with the *minimum carbonaceous intake*. If under these conditions a neurosal acarbonizing process continues to recur, then it is practically certain that the affection is to some extent pathologically prepotent.

In experimenting with a view to determine the minimum carbonaceous intake, exactitude is indispensable. Verbal instructions including general terms such as 'a little,' are in most cases worse than useless. The scale of diet should be written out in full. The largely or purely carbonaceous food-stuffs, such as the bread-foods and fats, should be carefully weighed; and the quantities graduated as nicely as dosage in the case of drugs. Milk should be measured: fish and meat weighed, though this is less essential. For several reasons, it is convenient to exclude sugar altogether, at any rate for a time: sugar is the most readily absorbable carbohydrate: its absence on the whole is less felt than that of the starches; and we have excellent substitutes in saccharin and saxon. *Unless accuracy of measurement is insisted upon, it is not improbable that hyperpyraemia may be increased through the increase of carbonization due to increased proteid intake.*

§ 947. In any given case, the minimum carbonaceous intake will vary in accordance with many circumstances. Probably the most important of these are the amount of physical exercise and the external temperature. Hence in the sedentary and in hot weather, the minimum carbonaceous intake will be materially less than in the active and in cold weather; and conversely. This, which has been already deduced, is readily susceptible of clinical demonstration. I have quoted the opinion of Clifford Allbutt that for brain-workers 'a somewhat liberal diet is required.' If it is permitted to substitute the expression a 'liberal allowance of proteid' for that of a 'liberal diet,' then I am in full agreement with this view. The beneficial influence, upon the brain-worker who has been living on an ordinary mixed diet, of largely retrenching the carbonaceous intake, and perhaps at the same time increasing somewhat the proteid intake, is much too marked and constant to be open to question.

It still remains a moot-point whether all of the fat laid

down in the human body is the result of a constructive process of the nitrogenous tissues—whether some of the ingested fat may not be simply withdrawn from the blood and deposited in the fat-cells unchanged. In the latter case, we might often promote fat-formation without calling to any large extent upon the anabolic capacity of the tissues; and this power would be extremely useful in such cases as are deficient in the fat-construction capacity. Further it may be that some carbonaceous materials are more readily burned off by the tissues than others—fats than carbohydrates, for example, or *vice versa*. These questions raise the further question whether, in some cases, we might not disperse hyperpyraemia by simply altering the constitution of the carbonaceous intake—by substituting, for example, certain fats for a portion of the carbohydrates—without largely reducing the total carbonaceous intake.

I am not prepared to answer this question. In a few cases in which hyperpyraemia had been dispersed by reducing the total carbonaceous intake, I have found that butter, cod-liver oil, and some other fats, could be taken in certain quantities with impunity, while any increase of carbohydrates was inevitably followed by a return of hyperpyraemic manifestations. And in chronic rheumatoid arthritis, my experience leads me to conclude that fats in some quantity are not only not deleterious but actually beneficial. But rheumatoid arthritis is not a test affection, since there are grave doubts as to its dependence upon hyperpyraemia; and in many typical hyperpyraemic affections—some migraines, asthmas, anginas, etc.—*any excess of fats is as injurious as an excess of carbohydrates*. Much clinical and other experimentation is required before such questions can be settled. Idiosyncrasies of many varieties will have to be considered and allowed for; and altogether there seems an enormous field for inductive work in this direction.

The practical difficulties attending the exact regulation of the carbonaceous intake in a mixed diet led Dr. Hawkes to propose and use a simplification of the plan recommended. He kept some patients upon the lean of meat and milk only, and obtained some most excellent results. Amongst these was the complete relief of an old-standing case of severe recurrent gastralgia for which the patient had undergone nephrorhaphy, much gynaecological interference, and a prolonged course of

Weir-Mitchell treatment without improvement (Case XLVI). The monotony of this diet operates to preclude excess, but there is, I think, another important influence. The milk has to be taken at frequent intervals and in small amounts throughout the day and night, and this precludes any sudden large intrusion of carbonaceous material into the circulation.

§ 948. We have seen that normally there is an exaggerated tendency to hyperpyraemia at certain definite periods, namely, (1) during the small hours of the morning : (2) at the end of the intermenstrual period ; and (3) at puberty and the menopause. Now it is reasonable that such special tendencies should be respected in framing a physiological diet ; and clinical experience will be found to confirm fully the expediency of the practice.

The incidence of many recurrent hyperpyraemic affections is, in some cases, solely on the small hours of the morning : this is perhaps especially true of asthma, angina, and epilepsy. In such recurrent nocturnal hyperpyraemic affections, it will be found of great advantage to insist upon the main carbonaceous supply being taken with breakfast : the midday meal should be less carbonaceous : the evening meal least carbonaceous of all. By such means, we attain the maximum carbonaceous intake compatible with absence of hyperpyraemia. The rapid combustion of the forenoon is capable in many cases of precluding hyperpyraemia, even after a heavily carbonaceous breakfast. In some nightly recurrent cases, chiefly asthma, I have permitted without mishap a heavy mixed meal at breakfast-time, including porridge and jam or honey : in these cases, the evening meal was taken early and consisted of almost pure proteid in small quantity.

But in some cases, the manifestations of daily recurrent hyperpyraemia (mainly headaches, secondary dyspepsias, and depression) tend to occur during the forenoon : in others, during the afternoon ; and in others again, in the early or late evening. Indeed, there are numerous individual differences in the time incidence of hyperpyraemic manifestations ; and it will always be found expedient to allow for such differences in apportioning the daily allowance of the purely carbonaceous food-stuffs.

There is a periodic week-end hyperpyraemia shown by the increased incidence of headaches, bilious and all neurosal

attacks, on Sunday and Monday. Such are manifestly due to the rest on Saturday afternoon and Sunday, combined with the increased eating and drinking customary on these days. But in other cases, the hyperpyraemic manifestations occur only on alternate weeks but still on the same days. This shows that the accumulation is really continuous throughout, and that the additional food at the week-end is really but the 'last straw.' This explanation, of course, points out the rational treatment.

Many hyperpyraemic affections tend to recur only at the menstrual period or when menstruation is impending; and it is reasonable to take advantage of this foreknowledge and apportion the carbonaceous intake accordingly. In most cases, we can foretell the date of the menstrual period with a close approach to accuracy; and I have found it of distinct benefit to increase the stringency of all dietetic restrictions during the greater part, if not the whole, of the pre-menstrual week. By doing so, we may often permit of a corresponding relaxation of dietetic restrictions during the rest of the month.

The special tendency to hyperpyraemia, and to the development or accentuation of hyperpyraemic affections, in the female sex at both puberty and the menopause, may be in great part anticipated by special care in graduating the carbonaceous intake at these epochs. The advantages of a lowly carbonaceous dietary at the menopause were fully appreciated by Tilt.

§ 949. Amongst the possible objections to the dietetic plan of treatment here advocated are two which are worthy of special notice. The first is important mainly from a practical, the second I think mainly from a theoretical, standpoint.

1. A meal which consists very largely of proteid, with a relatively small amount of fats and carbohydrates, undergoes as a rule very rapid digestion and absorption. Consequently the stomach remains empty between meals for a considerably longer period than that to which it is accustomed. In these circumstances, many patients experience unpleasant sensations of emptiness, sinking, or faintness. Food of any kind, even in very small amount, disperses such symptoms almost instantaneously; and so too will a drink, especially a hot drink, even if it consists of water only. In cases so affected, I have been accustomed to order a glass of hot milk, sometimes hot water

or tea, about three and a half hours after the last meal, that is, about one and a half hour before the next meal : in some cases I have allowed an unsweetened biscuit at the same time.

2. The theoretical objection referred to is the possibility of disturbing nitrogenous equilibrium so that there is a disintegration of the fixed nitrogenous tissues of the organism (compare § 4 *et seq.*). I may confess at once that I am unable to give a satisfactory scientific reply to this objection. In order to demonstrate that the diet scales which I have prescribed are capable or incapable of causing a loss of the nitrogenous capital of the body, elaborate and accurate experimentation would be necessary ; and for this I have had neither the leisure nor the competence. I can only state that I have not, with one or two exceptions, noted, during the continuance of treatment, any symptoms which could be reasonably ascribed to increasing debility of the muscles or other nitrogenous tissues. In the exceptions referred to, the symptoms consisted of a feeling of muscular debility, most marked in the muscles on the front of the thigh. In the few cases in which this symptom was experienced, a very slight addition to the carbonaceous intake was sufficient to give immediate relief. Probably the maintenance of nitrogenous equilibrium is greatly favoured by the administration of highly gelatinous soups ; for, as Schäfer points out, gelatin is the best proteid-sparer.

It is in the absence of symptoms pointing to waste and weakness of the nitrogenous tissues, that the practice of simply restricting the intake of purely carbonaceous food-stuffs contrasts favourably with systems in which such food-stuffs are excluded. The Salisbury diet consists of practically pure proteid ; and I have seen serious cardiac weakness, not to mention great general muscular debility, follow its strict enjoinderment.

§ 950. The cardinal importance of accurate dosage of the purely carbonaceous food-stuffs applies in its full force only to such persons as are deficient in the fat-forming capacity. In many such, whether the incapacity is congenital or acquired, a very slight excess of carbonaceous material will induce the clinical manifestations of hyperpyraemia. On the other hand, in those who are well endowed with this anabolic capacity, slight carbonaceous excess is often immaterial.

It is, therefore, of cardinal importance to promote as far as

may be possible the power of fat-construction in all cases in which this seems deficient. I must admit, however, that in many cases the fulfilment of this indication is no easy task. Probably the commonest of all dietetic mistakes is to pour in an excess of fats and carbohydrates on the view that leanness is purely a matter of deficiency of supply, whereas in very many cases it is mainly, if not solely, a matter of deficiency of function—of the anabolic fat-forming function. Hence we must proceed cautiously. In some cases the functional deficiency has arisen through deficiency of proteid: in these, an increase of proteid, combined with temporary restriction of the carbonaceous intake, is often rapidly successful. In others where there has been no conspicuous proteid deficiency, a mere reduction of the carbonaceous intake may suffice. In others again, the persistent regulation of the proteid and carbonaceous intake leads to a progressive increase of the fat-forming capacity, so that a gradual increase of fats and carbohydrates can be given without inducing hyperpyraemia and with the result that the amount of stored fat slowly augments. The increased weight will add to the combustion capacity of the organism and thus still further guard against hyperpyraemia. Finally in some cases fat-formation can only be increased by allowing a somewhat generous carbonaceous intake, relying for decarbonization upon hard physical exercise in the open air. Milk seems the most generally useful article of diet for the unduly lean.

§ 951. EXERCISE AND SLEEP.—Combustion of carbon being the main source of muscular energy, the amount of physical exercise will have to be apportioned to the carbonaceous intake. Although we still hear much of the danger of animal food for persons of sedentary habits, yet some, as we have seen, are commencing to take a different view. The view that it is easier for a physical than a mental labourer to be a vegetarian lends itself to easy verification. Many mentally active men, business or other, find their work easy, if not pleasant, until after the luncheon hour. Then they become drowsy and lethargic, yawns are suppressed with difficulty, and thought becomes burdensome. Such symptoms are commonly ascribed to dyspepsia, and it is true they often concur therewith; but they are equally common in persons possessing powerful digestions. Let such a one forgo his usual midday mixed meal, and take

in its place a few ounces of almost pure proteid, such as grilled steak with a very little carbohydrate—say half an ounce of toast: he will then find that he can continue his mental work without interruption and with undiminished facility.

There can be no doubt that he who is precluded from exercise, whether by occupation or physical disability, does well to cut down to a low level his carbonaceous intake. Nevertheless, it cannot be denied that such a one will present a standard of health which is lower—I think far lower—than that of another who is ingesting and absorbing a larger fuel supply, and who is exercising proportionately, other things being equal, of course. *Put otherwise, physical exercise has salutary influences over and above the mere dispersion of a tendency to hyperpyraemia.* Amongst these will be increased muscular anabolism and accretion, which will add to the combustion capacity of the organism and thus act as a safeguard against future hyperpyraemia. Thus muscular development becomes a most important therapeutic measure.

In prescribing exercise for its decarbonizing influence, the form is not of great importance: the best probably is such as brings into play the greatest number of muscles. Thus rowing, riding, bicycling, golfing, and walking are all excellent; and dancing, skipping, and various gymnastic exercises are highly useful as fall-backs in wet weather. Variety is a point of great practical importance.

In all forms, however, there are certain errors to be avoided. Many—though by no means all—hyperpyraemics are in wretched physical training: hence exercise should be light at first and gradually increased in severity as the treatment proceeds and as the muscular system develops. Accurate dosage here is as essential as in the case of the carbonaceous intake. As we have seen, sudden violent exercise, through its temporary influence on blood-pressure, is liable to precipitate or exacerbate neurosal paroxysms: hence, if severe exercise is advisable—and in not a few cases it seems the best of all therapeutic agents—it should never be severe from the commencement, but should attain severity gradually. When once the stage of general vascular relaxation and fall of blood-pressure has been reached, there is in my experience practically no danger of the occurrence of any neurosal paroxysm. Finally, exercise should never be prolonged so as to cause more than a *pleasant* sense

of fatigue. Probably with more than this the decarbonizing capacities of the muscular tissues are impaired: at any rate hyperpyraemic manifestations in many cases invariably follow—at a certain distance—*severe* fatigue.

§ 952. In regulating the diet we found it advantageous to take into consideration the tendency of hyperpyraemia to recur at special periods. Similar considerations should be allowed to weigh in regulating exercise.

Each meal is succeeded by a tendency to hyperpyraemia; but this applies only rarely to breakfast. Hence in many cases it is advantageous to insist upon some exercise after every meal: in this way we assist the physiological post-prandial rise of combustion. The advice is often given to rest after meals; and there are cases in which exercise at this time conduces to dyspepsia. But such cases are not nearly so common as is generally thought; and there are many in which exercise immediately after meals undoubtedly prevents the occurrence of dyspeptic symptoms towards the end of the digestive process. Such are no doubt secondary dyspepsias depending on glycogenic distension of the liver.

In nocturnal recurrent hyperpyraemia the least important exercise is that which follows breakfast, the most important, that which is taken between the evening meal and bedtime. The latter should be regulated in accordance with the case: in a few, I have found it possible to dispense with exercise at any other time.

In periodic week-end hyperpyraemia, exercise may with advantage be increased for a day or two before the expected onset of the paroxysm. Similarly with hyperpyraemic affections which tend to recur at fortnightly or other more or less regular periods. We have seen that with some women there is a subconscious impulse to increase physical exercise when menstruation is impending; and it is reasonable to copy Nature in this respect in cases of menstrual hyperpyraemia. But although it is advisable to increase it as the time for the paroxysm approaches, exercise should in no case be restricted to this period. In most cases probably the accumulation which eventually results in hyperpyraemia is continuous: hence as a rule exercise should be practised daily and regularly.

Massage and general faradization of the muscles may be regarded as therapeutic substitutes for ordinary physical

exercise. They are inestimable where voluntary exercise is impossible or for any reason contra-indicated. Both, as already mentioned, can be shown to increase combustion ; and massage has been proved to effect a reduction of blood-pressure.

Closely related to the regulation of exercise is the question of sleep. Sleep has a direct, as well as an indirect, influence in reducing the rate of combustion : hence the daily duration of sleep will have an important influence upon the rate of carbonaceous accumulation and so upon the occurrence of hyperpyraemia. Conformably, it will be found of great advantage in many cases to restrict—sometimes rigidly—the number of hours devoted to sleep. In a case of recurrent nocturnal epilepsy, sleep was limited to six hours with manifest advantage (Case XLIX).

§ 953. CLIMATE, EXTERNAL TEMPERATURE, AND FRESH AIR.—It is important, as already mentioned, to regulate the carbonaceous intake in some degree in accordance with the external temperature, that is, with the necessity for heat-production. In the tropics and in hot weather generally, the necessity for heat-production is reduced : hence the supply of fuel must be reduced. The fact that healthy persons supplied with an excess of fuel have the capacity for its combustion and for the dissipation of the additional heat so produced does not negative this principle ; for, as has been urged, such combustion is in great part a mere response to the necessity for decarbonization. And the general clinical results of a reduction of the carbonaceous intake in hot weather upon the comfort and well-being of the individual will hardly be questioned by any of those who have made the experiment. At the same time, it cannot be denied that as a general rule more is to be gained by the tropical hyperpyraemic from a visit to a cold climate, where his capacities for decarbonization are increased, than from a reduction of his fuel intake to the level of his capacities in the tropics. In other words a cold climate, more especially when it involves a change of climate, *has many salutary influences over and above the mere increased capacity for combustion which it confers* ; and this we should anticipate, since a tropical environment must be regarded as abnormal for the Northern European races.

In many ways, then, a reduction of the external temperature is a highly valuable—often an essential—therapeutic

measure, and should never be omitted from consideration in the treatment of tropical and subtropical hyperpyraemic patients ; and subsidiary means of applying external cold, such as sea-bathing, cold shower baths, etc., are all of great advantage in appropriate cases.

§ 954. Without questioning the supreme importance of a maximum supply of fresh and pure air, it can hardly be doubted that a part of the salutary influence of open-air treatment as applied to consumption is due to increased exposure to cold. But this treatment, or some modification thereof, is capable of giving results in many affections, more especially in such as depend upon hyperpyraemia, comparable with, if not superior to, those which are obtained in pulmonary consumption. I am in the habit of instructing many patients to sleep with the windows and doors wide open, or even to sleep upon the verandah, except in the coldest weather : also to cover themselves with the minimum of bed-clothes compatible with comfort and sleep. So perhaps is mitigated a tendency to over-heavy fall in the rate of combustion during sleep and consequent nocturnal hyperpyraemia. It may be safer—it is certainly more expedient considering current prejudices—to arrive at an open-air life by degrees and to institute a process of gradual hardening ; but it is irrational to think that a mode of life which is beneficial to a debilitated phthisical patient cannot be endured by one who is suffering under some much less exhausting complaint. How much of the benefit which follows an open-air life is due to increased exposure to cold, and how much to increased supply of pure air, is of course difficult to decide; nor from a practical standpoint is such decision of much importance. They both have at least one salutary influence in common, namely, increased decarbonization of the blood ; and no one who has not made the experiment can form an approximate estimate of the benefit to health of sleeping in the open. The sleeper wakes with a feeling of freshness, exhilaration, and vigour, otherwise unattainable. This is especially conspicuous at sea.

TREATMENT OF URICAEMIA

§ 955. We have seen that uricaemia is largely a matter of retention, and that such retention, commonly at least, depends upon hyperpyraemia or a tendency thereto. Further in the majority of cases such uricaemia is a mere symptom and is not responsible for any immediate pathological result. Consequently in the cases to which this applies, the treatment of the uricaemia will consist in the dispersion of the hyperpyraemia. But uricaemia depends also largely upon the introduction of foods rich in uric acid-forming material, more especially roe, sweetbread, meat, and extractives generally; and there are some affections, notably acute, subacute, and chronic articular gout, uro-lithiasis of some kinds, and renal cirrhosis, in which uric acid is an essential pathological factor. In these affections therefore, and in cases where these affections are to be anticipated, it is expedient to restrict, as far as may be, the ingestion of articles of food containing much uric acid-forming material.

But in articular gout at any rate, and probably in renal cirrhosis and some cases of uro-lithiasis, the uric-acid factor is fraught with pathological consequences probably only in the presence of hyperpyraemia. Hence it is mainly during the continuance of hyperpyraemia that abstinence from the above-named and similar food-stuffs is urgently demanded. I have already referred to a case in which a meat diet undoubtedly precipitated, and in all probability intensified, a paroxysm of acute articular gout which was impending when treatment was commenced (Case LIX). The incident clearly demonstrates the danger of giving food-stuffs rich in uric acid-forming material, in the presence of existing hyperpyraemia. But the subsequent history of the case demonstrates that the continued ingestion of the same food-stuffs *may* be free from danger when the arthritic paroxysm is over, that is, when the gouty pyrexial acarbonization has dispersed the hyperpyraemia.

Nevertheless it must be admitted that persons suffering from complaints such as articular gout, in which uric acid is an *active* pathological factor, run a real risk at most times through ingesting articles of diet which contain much uric acid-forming material. For we are ignorant of the chemical

constitution of hyperpyraemia; and moreover we have no certain test by which we may demonstrate its complete dispersion. After an acute and fairly prolonged (twelve to sixteen days) attack of arthritic gout, there can indeed remain little doubt that hyperpyraemia is in abeyance. But the pyrexial arthritis varies widely in severity and duration; and it is quite likely that in many less severe cases acarbonization is inadequate. Hence the resumption of a diet containing much uric acid-forming material may often induce an arthritic relapse.

For these reasons, *I am especially anxious to avoid the least degree of dogmatism in the dietetic management of arthritic gout.* Though I have no hesitation in recommending a diet comprising a moderate preponderance of meat (red or white) and fish, in the great majority of hyperpyraemic affections, yet I hesitate to do so in the case of arthritic gout. On the one hand, I have seen cases markedly benefited thereby, and some of these had been going from bad to worse under vegetarianism, or modified vegetarianism: on the other hand, I have seen cases in which a small mainly meat diet caused distinct exacerbation of the arthritis, and this occasionally even under conditions which seemed capable of precluding hyperpyraemia; but, as already mentioned, we possess no certain test of the absence of hyperpyraemia.

§ 956. SUGGESTIONS AS TO THE TREATMENT OF ARTHRITIC GOUT, PREVENTIVE AND OTHER.—Having regard to the view that acute recurrent gout arises through the prolonged persistence of some degree of hyperpyraemia (§ 607 *et seq.*) whereby there occurs a gradually increasing uricaemia from deficient renal excretion, it may be suggested that a rational, if not an effectual, prophylactic would consist of the institution at regular intervals—say one month in cases where the attacks are separated by wide intervals—of practical fasts lasting a day or two. In this way we should be imitating in some respects that physiological monthly acarbonizing process, menstruation, which, there is reason to believe, is often an efficient preventive of articular gout; and, as happens with menstruation, we should expect to obtain, as a result of such periodic abstention, some increase of uric acid output, with releasement of prior uricaemia. It would not perhaps be necessary to insist upon complete abstention from food during such periods: the

enjoinment of a diet which is lowly carbonaceous and at the same time free from uric acid-forming material would probably be sufficient. I have little practical experience of this method : acute recurrent gout is becoming comparatively rare. But the following case is suggestive of success :—

A gentleman who had previously enjoyed remarkably good health, commenced late in life to have frank articular (great-toe) gout at regular intervals of twelve months. The attacks were early spring attacks : they occurred in the month of September, which corresponds to March in the northern hemisphere. He had already suffered from two attacks : each of these was preceded for some weeks by constant neuralgia, distinct rise of blood-pressure, dyspepsia, and other symptoms, indicating depraved general health. Towards the end of August, eleven months after the onset of his previous attack, since when he had remained in perfect health, he began to suffer once more with neuralgia, and palpation of his radial seemed to show an increase of arterial tension. He was then ordered gentle physical exercise (slow walking short of fatigue), and was placed upon the following lowly carbonaceous and practically uric-acid-free diet :—One lightly boiled egg with half an ounce of toast and a little butter, three times daily, together with four pints of milk taken in divided doses throughout the day. On this he lost a little weight, which he could well afford, but he also lost in the course of eight days all neuralgic symptoms and his arterial tension fell. The diet was kept up for nearly three weeks and thereafter modified gradually. Nine months later he had remained in excellent health.

It seems highly probable that the treatment adopted actually anticipated and prevented a third attack of frank articular gout.

But in the treatment of existent arthritic gout, it might be expedient to copy the natural conservative paroxysm more closely. Bearing in mind the prolonged period of good health which so commonly follows the early attacks of frank arthritis, and the arguments which seem to demonstrate with a near approach to certainty that the symptomatic pyrexia is the actual salutary factor in such cases, the treatment of arthritic gout by the induction of a mild artificial pyrexia naturally suggests itself. We have seen arthritic gout greatly benefited during the continuance of suppuration over uratic nodules (§ 593), and during the intercurrence of other septic and inflammatory affections, such as chronic ulceration of the cervix

uteri (Tilt), tonsillitis, pneumonia, and bronchitis: and we have seen the arthritic condition promptly relapse upon the cessation of some of these substitutive inflammatory affections. Would it not be rational therefore to extend the use of the seton, which has proved so useful in many other hyperpyraemic affections, to some cases of arthritic, and especially of chronic arthritic, gout? The pyrexia induced by the seton is of course but slight: nevertheless it may be prolonged indefinitely without serious injury; and it would to some extent supply in cases of chronic apyrexial gout the conservative feature which is lacking. Through the use of the seton for a somewhat prolonged period, we might, with but little inconvenience to the patient, elevate the rate of continuous combustion even during the early hours of the morning, and so avert the tendency to hyperpyraemia and uricaemia, ever present in chronic arthritic gout; and this, without interference with the more orthodox methods of treatment, dietetic or medicinal. In this way, we might permit of the absorption of uratic deposits, and promote a considerable degree of improvement in the condition of the damaged articulations and in the general health.

Of course, we have many means of inducing artificial pyrexia: we have already seen that two of these, namely, the subcutaneous injection of sterilized turpentine and vaccination, have been used with advantage in hyperpyraemic affections; and there seems no reason why these also should not be extended to the case of arthritic gout in appropriate cases.

TREATMENT OF THE INDIVIDUAL

§ 957. Moxon said:—‘ It is quite as important to know what kind of a patient the disease has got, as to know what sort of a disease the patient has got.’ This witty aphorism ceases to be even seemingly paradoxical when applied to hyperpyraemia and hyperpyraemic affections. For only through a thorough knowledge of the individual and of his different functional peculiarities, idiosyncrasies, and proclivities, can we hope (1) to determine the special combination of factors—whether of supply or of function or of both—which has led to hyperpyraemia: (2) to break up such faulty combination; or (3) to foresee the evolutionary lines which hyperpyraemia, if unrelieved by treatment, will tend to pursue in each individual case.

The direct avenues to such knowledge comprise :—1. An accurate pathological life-history of the individual since infancy. This as a means of investigation does not, I am inclined to think, rank so high with the profession—at least it does not occupy so large a share in the data advanced for diagnosis—as formerly. Probably the change is an inevitable result of the rapid advance of specialization and of the multiplication of the aids to physical examination. But in the investigation of hyperpyraemia, life-histories are indispensable ; for they frequently show numerous hyperpyraemic manifestations undergoing the most marked modifications as age advances and as habits, occupations, and surrounding conditions alter. And it can hardly be questioned that the regular family physician who has attended the parents in several succeeding periods of their life, who has guided the children through their infantile and juvenile complaints, and who consequently is in a position to form an accurate estimate of the capacities and proclivities peculiar to the family, is the one of all others best fitted to profit by the knowledge so gained.

2. An exhaustive physical examination. This will serve to detect secondary factors capable of causing pathological prepotency, a question of the greatest importance from a therapeutic standpoint. And by this means only shall we succeed in disclosing the intermediate and ultimate results, reparative or degenerative, of long recurrent or unrelieved hyperpyraemia, whether such results depend proximately upon the humoral condition, upon the hepatic or circulatory manifestations of the humoral condition, upon the uric-acid complication, or upon some combination of these : in general terms, physical examination will serve to make manifest to what extent strained or perverted function has already succeeded in effecting organic changes. Unlike the indispensability of life-histories, the indispensability of physical examination needs absolutely no insistence at the present day.

GENERAL CONCLUSION FROM A PRACTICAL STANDPOINT

§ 958. From the standpoint of practical medicine, preventive and curative, the most generalized conclusion to be drawn from a comprehensive survey of the theory of hyperpyraemia is

I think, that we cannot any longer afford to ignore the 'stoking of the human engine.' Seeing that the capacities of the individual for the physiological management of his fuel supply are widely variable, the intake of fuel will have to be graduated, more accurately than heretofore, to his capacities, not less than to his seeming necessities: it will have to be graduated to his capacity for digestion and absorption, to his capacity for regulating the income (perhaps here inversely in many cases), to his capacity for expenditure from the blood, whether by katabolism, anabolism, or direct loss. Only by such means can we hope to avert pathological forms of regulation or expenditure, or continued pathological accumulation: only so can we hope to maintain purely physiological carbonization and purely physiological acarbonization. We may nevertheless frequently modify or increase the physiological capacities of the individual; and this may often be the most expedient procedure. In that event, of course, the fuel intake may be modified or increased accordingly with advantage.

APPENDIX OF CASES

SEVERAL considerations united to determine the selection of the cases which constitute this appendix. Perhaps the chief of these was the length of time during which the patients remained under observation: it was deemed useless to include cases which rapidly disappeared from notice, whatever the apparent immediate result of treatment. Another consideration was a desire to illustrate the protean characters assumed by the manifestations of hyperpyraemia, both in different individuals and in the same individual extending over long periods. Yet another consideration was a wish to indicate some of the limitations as well as many of the possibilities of acarbonizing treatment. The series cannot, therefore, be regarded from a statistical standpoint: indeed the nature of the subject, more especially the absence of clear lines of demarcation between the various affections, would effectually preclude statistical treatment.

CASE I.—*Gastric dyspepsia, probably primary in the main: complete relief by rearrangement of diet. Under observation 2½ years.*

Edwin C—, aged 27: weight 7 stone 11½ lbs.

Of fairly active habits, but had been almost constantly dyspeptic for four years. Flatulence was the most prominent symptom: it came on almost invariably about four hours after meals. He was very thin, and had been endeavouring to fatten himself by taking a large amount of carbohydrate food in the form of milk puddings, porridge with milk and sugar, etc. He found himself much worse in consequence, and had been losing rather than gaining in weight.

On August 29, he was directed to take about three ounces of proteid (white fish, eggs, lean meat) at each meal, with one ounce of hard carbohydrate: also to take fluids (tea with milk) only between meals and without any food. He ceased forthwith to suffer from

dyspeptic symptoms, and continued free until September 12, when he had a little flatulence after meals. On enquiry this was found to be occasioned by his taking against orders a small cup of tea immediately after each meal.

On September 26, he had remained quite free from dyspepsia but had fallen in weight to 7 stone 7 lbs. His carbohydrate intake was now increased but not altered in kind, and he was allowed butter. As a result, he commenced to gain in weight, and on October 29 weighed 7 stone 8½ lbs. He was then ordered to take some sweet biscuits or a moderately large slice of some light cake, as a second course after each meal, but still to avoid fluid except as before. He remained free from dyspepsia and continued to increase in weight. On December 5 he weighed 7 stone 9 lbs.: on January 29 8 stone 1¼ lb.

Two years later, he remained free from dyspepsia and in good general health.

Remarks.—This case well illustrates the necessity in gastric dyspepsia of providing for the salivary digestion of starch foods by withholding fluid at meal-times, whether as drink or as an admixture in any quantity with the food. It illustrates also one of the commonest of dietetic errors, namely, the attempt to increase fat-formation by increasing the supply of fat-forming food without regard to the functional capacities of the organism.

CASE II.—Dyspepsia and consequent malnutrition with vertiginous attacks, anaemia and tendency to purpura. Relief from all symptoms by careful dieting.

Thomas M—, aged 72 years, tall, emaciated.

Had suffered from almost continuous dyspepsia for above thirty years, with much flatulence, pain, and pyrosis. He was without teeth, very deaf, and complained greatly of vertigo, associated with sensations of fulness in the head and coming on in paroxysms, especially on exertion: of late he had been afraid to go even a short walk unaccompanied. He was distinctly anaemic: his ankles oedematous; and his vascular tissues in such a state that a light blow with one finger caused perceptible bruising.

He informed me that he had made dyspepsia a special study for years, and had read many works upon food and food diseases. He leaned to the view that animal food was the great modern dietetic error, and he was firmly convinced that meat was of all things the least digestible, at any rate in his own case. Consequently, he had eschewed meat for years and had moreover struck out from his dietary one food-stuff after another, until when I saw him his sole sustenance consisted of bread or biscuit, soaked in hot cocoa, with milk and sugar.

Manifestly, the management of such a case presented under ordinary conditions unusual difficulties. Accordingly on July 17 he was placed in a private hospital, where his personal views were of less moment.

After a short preliminary fast, during which he took nothing but hot water rendered faintly alkaline with bicarbonate of soda, he was supplied with four meals daily consisting of beef, minced according to the Salisbury plan, together with baked bread. The former did not exceed eight ounces in the twenty-four hours: the latter amounted to somewhat less, and on account of the total absence of masticatory power was broken into small pieces, which he was directed to retain in his mouth until they were softened by the saliva and easy to swallow. Fluid, at first alkalinized hot water, later hot weak tea, was only allowed between meals when the stomach was presumably quite empty.

As a result of this treatment, his dyspeptic symptoms, including the pyrosis, ceased absolutely on the first day. Vertigo ceased on the second day. At the end of a week his colour had distinctly improved, and there was no tendency to bruising of the tissues from slight causes, or to oedema of the ankles. He became stronger and resumed his solitary walks with full confidence. He thought his hearing improved slightly, and this was also the opinion of his attendants. A week later, he had an attack of diarrhoea, due, I think, to some excess of meat. The attack, however, was treated by simple abstention from food, without drugs: it lasted but one day, and left him none the worse.

His diet was then varied somewhat and he was allowed to go home, but he was instructed to observe carefully the following three rules: (1) to take thrice daily a certain amount of easily digestible proteid: (2) to take starch foods only in a dry form; and (3) to avoid fluids at meal times.

Six months later I heard of him. He had much improved in health in all ways, and remained free from gastric discomfort.

Remarks.—This case was manifestly one of simple malnutrition from carbohydrate dyspepsia and deficient proteid intake.

CASE III.—*Secondary dyspepsia of some years' duration: vague nervous symptoms: insomnia: immediate relief from all symptoms by restriction of the carbonaceous intake. Under observation 4 years.*

Charles S—, aged 35: weight 9 stone 10½ lbs.: height 5 ft. 9 ins.

He was of a lean habit of body and had suffered from flatulence, distension, and pain after almost every meal for some years: of late he had had distressing insomnia and many ill-defined nervous symptoms, for which he had commenced to take alcohol in moderately large doses. He had tried many kinds of drug treatment, including

a variety of artificial digestive ferments, with nothing but slight temporary relief. He took the ordinary mixed diet: pulse 72, rather high tension.

This case was at first regarded as one of primary dyspepsia, as one, that is to say, in which the error lay in the kind of food or in its mode of presentation to the organs of primary digestion. He was advised to avoid fluids at meals, to eat slowly, masticate thoroughly, and to take all starchy foods in a hard and dry state, so as to insure adequate insalivation. Many variations were made in his diet for some weeks; but during the whole of this time there was not the least improvement in his condition.

He then remarked that whenever he gave up for a time his rather sedentary occupation, and took a holiday which he invariably spent in some sporting expedition, he ceased forthwith to suffer from all dyspeptic troubles. This seemed to give the clue to the pathological cause of his condition, namely, more or less persistent glycogenic distension of the liver secondary to hyperpyraemia. He was then placed upon a diet of pure proteid. During the next few days he lost several pounds in weight, but he rapidly lost all his symptoms, dyspeptic and other. He became mentally clear and more energetic physically: slept perfectly; and lost all feeling of nervousness and inclination for alcohol. Carbohydrates were then added to his diet in slowly increasing quantities, also milk, and some fat, until he began to increase in weight. Two months later, he weighed over 10 stone and was in perfect health. Twelve months later he weighed 10½ stone and remained well and energetic.

Remarks.—That this case was one of secondary dyspepsia dependent on glycogenic distension of the liver and consequent mechanical congestion of the digestive mucosae, hardly admits of doubt. In such cases, the sudden subsidence of all dyspeptic symptoms upon the withdrawal of the purely carbonaceous food-stuffs, is strictly comparable, both from a clinical and pathological standpoint, with what occurs at the onset of their disease in some diabetics who have had antecedent dyspepsia (§ 81). Clearly in these cases reduction in the quantity of food, especially the purely carbonaceous foods, is a more important therapeutic indication than any alteration in the kind of food; and I do not doubt that many failures to relieve dyspepsia depend solely on neglect of the quantitative factor.

CASE IV.—*Chronic dyspepsia probably in part dependent on glycogenic distension of the liver: complete relief by diet. Under observation 6 months.*

Emily M——, aged 24: recently married.

Good health until seven years ago, when she nursed her mother through an illness (asthma) lasting for some months. During this

time, her meals were irregular in time, quantity, and quality: they consisted mainly of tea and bread and butter and were taken at odd times. Dyspepsia commenced then and has persisted since with a few intervals. Originally she had a very high colour: of late she has been anaemic and somewhat yellow; and has lost much flesh. She has never had a headache, is not subject to catarrh or other minor troubles: indeed dyspepsia is her sole complaint. Menses regular and painless: bowels regular.

The dyspeptic symptoms come on about one hour or one hour and a half after each meal: they consist of severe pain in the cardiac region and left shoulder-blade, associated with much distension. She finds that a *long walk has a marked influence in relieving the discomfort.*

She has had much medical treatment, drug and other: in general she has been advised to take a light carbohydrate diet and to avoid meat, especially butcher's meat: this she was only too willing to do. At the time of her first visit to me she was taking, for breakfast, bread and butter and jam, with milk and hot water: for lunch, the same: for dinner, mainly vegetables such as beans with gravy, followed by a milk pudding. She had been provided with a soft stomach tube, and was using lavage three times weekly.

On July 7, she was ordered to cease all food, and to sip hot water at frequent intervals. Total abstinence from food continued until the evening of the 9th: she then had a little boiled fish. On the 10th, she had some boiled fish for breakfast: carefully cooked mincemeat for lunch and dinner. Next day a little hard carbohydrate (ship's biscuit, toast, or pulled bread) was added to each meal: no fluid being allowed, except on an empty stomach between meals. On July 17, there had been no symptom of dyspepsia since the initial fast: she was very hungry between meals and had lost four or five pounds in weight. Carbohydrates were accordingly increased. On July 20, there was a slight relapse, due probably to a too rapid increase in carbohydrate: this passed off in two days.

On September 27, there had been no further relapse: she had more than regained her former weight: was well in all respects, strong, energetic, and of good colour: for the last five weeks she had relaxed considerably her dietetic rules, but continued to take proteid thrice daily; and to avoid soft starch foods in excess.

Five months later, she remained in excellent health: her complexion had lost its sallow tint and become distinctly ruddy.

Remarks.—Two facts point to the probability that an unphysiological degree of glycogenic distension of the liver contributed to the continuance of the gastric dyspepsia in this case: (1) the fact that physical exercise, which admittedly tends to empty the liver of glycogen, always gave marked relief; and (2) the highly salutary

influence of the initial fast, which of course operates similarly on the liver. The influence of the latter might, of course, be explained by the rest to the gastric mucosa, and this rest was no doubt in any case an important factor in the relief. And there was ample in the previous dietetic treatment of the patient to account for a purely primary gastric dyspepsia. The organ was constantly flooded with liquid, non-insalivated, and therefore undigested, and indigestible, carbohydrate food-stuffs ; and proteid was grossly deficient.

CASE V.—Dyspepsia and morning headaches. Complete relief by diet.

Mrs. M—, aged 35.

She is a great sufferer from dyspepsia, and for the last six months she has awoke in the morning with headache which sometimes passed off after breakfast and sometimes continued more or less through the day. Both symptoms are regularly accentuated when menstruation is impending.

Treatment.—To avoid sugar and everything containing sugar : all starch foods to be taken in a dry, hard form, without drinking.

Result.—A month later this patient wrote saying that a few days after commencing treatment, both dyspepsia and headache ceased and did not recur.

Remarks.—In such cases the headache is often regarded as reflex and due to the dyspepsia. This may be so. But, according to the views advocated in this work, the majority of such cases are explicable as follows:—There is more or less continuous hyperpyraemia accentuated by the retarded combustion of sleep : the hyperpyraemia leads directly to vaso-motor headache, indirectly, through glycogenic distension of the liver, to secondary or hepatic dyspepsia. The only rational treatment is a decrease of the carbonaceous income or an increase of the carbonaceous expenditure.

CASE VI.—Periodic bilious attacks or sick-headaches of about thirty years' duration : dyspepsia : obesity : acne rosacea. Carbonaceous restriction. Sudden and permanent cessation of bilious attacks and dyspepsia : gradual subsidence of obesity and rosacea. Under observation 4½ years.

Edward A—, aged 32 years : weight 12 stone 13 lbs.

Had suffered from periodic ‘bilious attacks’ or ‘sick-headaches’ for as long as he can remember. He left school at the age of 16 and spent some time in the bush because his medical attendant attributed his affection to over-study.

The attacks occurred about once a fortnight, almost invariably at the end of the week (Saturday or Sunday). One month is the longest interval of freedom that he can remember.

Description of recurrent attacks.—On the day on which the attack occurred, he would wake in the morning feeling unusually well and would continue to feel so until about 10 A.M. Then he would begin to see black specks before his eyes moving about in all directions. This would last for about half an hour, when vomiting, at first of food, afterwards of bile, would come on and continue for about two hours. This was accompanied—not preceded—by severe general headache. A little later, he usually obtained an hour's sleep. On awaking, he would have a dull aching pain all over his head, intensified by stooping or by exertion. The headache remitted towards the evening and ceased during the ensuing night. The following day and for the next few days he would feel unusually well. Of late the attacks had shown a tendency to increase in frequency: before commencing treatment they had occurred on three successive Sundays.

Besides the above attacks, he suffered almost daily from dull frontal headache always associated with flatulence and other dyspeptic symptoms, such as heartburn, pain over the ensiform, palpitation, and some gripping pains.

Of recent years he had become obese, and, although an extremely abstemious man, had developed a florid complexion of a somewhat cyanotic tint with incipient, but distinct, rosacea affecting the nose and immediately adjoining area.

His food habits were feminine. He was especially fond of sweets such as jam and honey, of pastry, puddings, and bread and butter; he was always a small meat eater.

On September 2, 1899, he was dieted as for obesity. He was allowed three or four ounces of protein at each meal, with about three-quarters of an ounce of toast with a little butter: also green non-starchy vegetables, and the less saccharine fruits in moderation: tea with a little milk but no sugar was allowed *ad lib.* The treatment was begun on the Monday following an unusually severe bilious attack.

In three months he had fallen in weight to 10 stone. All symptoms of dyspepsia ceased absolutely on the first day of treatment: he had had no trace of headache or any kind of bilious attack. The cyanotic tint disappeared from his face, which became much paler, but retained a fresh healthy colour. His nose had returned almost to the normal colour, but still showed the small protuberances associated with early rosacea. A few weeks after commencing treatment, he informed me that he had accidentally cut his finger and was struck with the fact that his blood was of a much brighter and lighter red than formerly. He found a great increase in energy, physical and mental, and a total loss of irritability of temper, which he was conscious had been increasing. He says if the

dietary were much more stringent, he would never depart from it, since he now knows what health means for the first time in his life.

Note made on March 17, 1901.—No bilious attacks since commencement of treatment. On one or two occasions he has had slight dyspeptic symptoms, following some prohibited article of diet : he has made hardly any alterations in his food habits. He volunteers the following : ‘ I can induce flushing of the nose with the utmost certainty at will : it is only necessary to take some pineapple, mangoes, or other sweets at lunch (1 P.M.). The flush commences about 2 P.M. and gradually wears off in two or three hours, always before 6 P.M. I am sure it is the sugar : apples have no such effect.’ These flushes are quite unassociated with dyspepsia.

Note on March 12, 1902.—Condition unchanged : the bilious attacks which had been more or less regularly recurrent for something like thirty years have been totally absent from the day of commencement of treatment, a period of two and a half years.

Note in March 1903.—Remains absolutely well : no bilious attack since commencing treatment.

Note in April 1904.—Remains absolutely well : no bilious attack since commencing treatment; but he has recently been again increasing in weight and is now a little corpulent. This results from a gradual increase in the amount of starch foods, consequent on increasing confidence in the permanence of his cure.

Remarks.—This case is one of the most striking of the series from a therapeutic standpoint. The immediate and permanent result was brought about by the mere omission of sugar and restriction of starch foods (fats had never been taken in excess). There was no increase of exercise, nor other alteration in his daily routine. Hardly less striking than the cessation of all gastro-hepatic disturbance, was the improvement in complexion and temper. No better example of marked physiological prepotency of a recurrent acarbonizing process could be adduced : his carbonaceous intake is now sufficient to cause a mild degree of corpulency, yet he remains free from all forms of pathological acarbonization and hyperpyraemic manifestations.

The frequent occurrence of cases such as this demonstrates the futility of attempting to draw any sharp line of demarcation between bilious attacks and migraine. Some physicians having regard to the fact that the vomiting invariably preceded, and seemingly gave rise to, the headache, would doubtless include it under the former as a digestive disturbance : others, accepting the dictum of Gowers that ‘all sick headaches are migraine,’ under the latter as a nervous disorder. For us it is, of course, a recurrent vaso-motor acarbonizing

process, depending upon hyperpyraemia and glycogenic distension of the liver, and dispersing both conditions.

CASE VII.—*Recurrent bilious attacks or migraine of between sixty and seventy years' duration, alternating with dyspepsia: complete relief by diet and exercise. Under observation 2½ years.*

Mrs. B. W—, aged 71: weight 8 stone 12 lbs.: tall and thin: very few teeth left and those in bad order: native of Scotland.

Had suffered from recurrent bilious attacks from early childhood to the time of coming under treatment, a period of certainly over sixty years. During menstrual life the attacks occurred at monthly intervals about the onset of each catamenial period but occasionally at other times. The headache was general and followed by vomiting: it was usually present on waking in the morning. About fifteen years ago (i.e. some considerable time after the menopause) the attacks altered in character. The pain became limited to the left half of the head, and she began to suffer from indigestion. The headache and the indigestion alternated, that is to say, she was only free from indigestion during the time she was suffering from headache. Of late the headache had usually persisted on and off for a fortnight. She had also become subject to attacks of 'feverish diarrhoea.'

On August 28, 1901, she had suffered from the headache for two days. She was then ordered to take two ounces of finely minced beef with half an ounce of stale bread, three times daily without fluid, which was allowed only between meals. The headache, which as already said usually persisted for a fortnight, ceased two days later on August 30. On September 4, she had remained well as regards the headache and dyspepsia, but complained of being empty and weak. Accordingly, she made several ill-advised additions to her diet (amongst these the inevitable porridge) and relapsed. The scale was then rearranged as follows:

Breakfast.—Four ounces of fine mince or 4 ounces of fish; or 2 ounces of either. One ounce of baked bread.

11 A.M.—Tea with milk: no food.

1 P.M.—Mince, fish, eggs, in all 4 ounces; or a similar quantity of tripe without sauce: baked apples: one ounce baked bread.

4 P.M.—Tea as at 11 A.M.

6 P.M.—Same as at 1 P.M.

Before bedtime.—A little hot water.

February 17, 1902.—On the above diet, with a few slight additions and variations, she has remained in excellent health for the last five months. She has had no dyspeptic symptom or headache: has felt stronger and more active than for years; and spent much of her

time walking in the open air, especially in the evening. She has not, however, added to her weight.

September 29, 1903.—Under this date she wrote:—‘ I am very pleased to tell you that I am still enjoying the good health which your treatment gave me. I have no indigestion and seldom a headache. I live according to your prescription as far as possible, feeling that any departure would be risky. I take a walk every day.’

April 1904.—Remains in good health.

Remarks.—This case stands alone in my experience. The patient at the age of 73 finds that her almost regularly recurrent bilious attacks or migraine, which had attended her for probably nearer seventy than sixty years and which she regarded as ‘ constitutional’ and therefore inevitable, depended simply upon a slight excess of those bland, unstimulating food-stuffs, which are at the present day almost universally deemed harmless and peculiarly suited to the nourishment of women and children. The result shows that even the most prolonged recurrence does not necessarily lead to unconquerable pathological habit (pathological prepotency).

CASE VIII.—*Recurrent bilious attacks or migraine. Complete relief through diet and exercise. Under observation 4 years.*

Edmund B——, aged 36: weight 13 stone 10 lbs.

Up to ten years ago he was in perfect health. He had been leading a very active life, in fact training constantly for sculling and rowing under Hanlon, the Canadian. Hanlon’s training diet consisted of grilled meat, three times daily, not limited in quantity, together with bread and very plain milk and starch puddings.

At this time he married, and although he continued to lead a life more active than the average, he gave up formal training and with this reverted to an ordinary diet, that is to say, he ate whatever he felt inclined to eat. As a matter of fact, his tastes led him to indulge rather freely in bread and butter, porridge, puddings, cakes, etc.; but he continued to take a fair amount of meat.

About this time or shortly after two things commenced, but so insidiously that he cannot fix the date of their commencement. (1) He began to accumulate fat; and (2) he commenced to suffer from headaches. The latter were always preceded and accompanied by visual disturbances. Whenever the visual disturbance appeared he never failed to suffer later from headache; and the headache was severe in proportion to the severity of the visual disturbance.

The visual disturbance consisted of moving black rings which usually occupied the exact centre of the field of vision and caused much annoyance in reading and writing. The headache which followed was mainly frontal and was especially severe just above, and in, the eyeballs: these felt distended, and firm pressure gave relief.

Occasionally when the visual disturbances and headache had been especially severe, violent bilious vomiting occurred, followed for several days by a feeling of unusual well-being.

He had discovered for himself that he had at command three means by which he could modify the severity and frequency of the attacks. These were, (1) severe and constant exercise : (2) temporary starvation ; and (3) purgation.

For the last five years his attacks, which had been irregularly recurrent, have become more frequent. Of late he has been rarely free from the visual disorder ; and he has suffered from some degree of headache almost constantly.

During the ten years since he gave up training, he had suffered more or less from dyspepsia : this has been especially severe of late. During the last year or two, he has suffered from almost insuperable somnolence after the midday meal and has contracted the habit of sleeping heavily for an hour or two at this time, waking with a foul mouth and sense of general discomfort. He has always been extremely abstemious.

He was directed to take from three to five ounces of protein (lean meat, white fish, etc.) at each of his three meals : his carbohydrate intake was limited to one ounce of hard toast with very little butter at each meal : green non-starchy vegetables raw or cooked were allowed *ad lib.* Special directions as regards exercise were unnecessary, as he did most of his work on a bicycle.

He lost a stone and a half in about six weeks, falling to about his normal weight. During the first month, he adhered strictly to the prescribed scale of diet : during the whole of this time the visual disorder, the headaches, and the dyspepsia were in complete abeyance. Later, he began to be a little careless and the first two groups of symptoms began to reappear slightly. At the following Christmas he 'let himself go a bit' and all his symptoms recurred. He could always trace a distinct connexion between departures from his prescribed scale of diet and the occurrence of symptoms.

Six months later he told me he remained in perfect health, except on a few occasions after he had exceeded in the matter of food : that although he is now conscious as always of the summer heat, yet he feels that it does not now exhaust or even inconvenience him as previously. He can take violent exercise with only slight perspiration ; and has ridden his bicycle all through the hot season wearing a starched shirt and high collar : this he was never able to do before without intense discomfort.

He is conscious of a great increase of energy, physical and mental, and has no tendency to somnolence after meals. He was commencing to be bald, but has noticed a new growth of hair of late.

Four years later he remained in perfect health.

Remarks.—The case illustrates a very common form of recurrent hyperpyraæmia, dispersed by recurrent acarbonization; also a very common cause of hyperpyraæmia, namely, the abandonment, or partial abandonment, of athletic exercises without concurrent restriction of food. It illustrates also the possibility of regulation of the body temperature by diminution of heat production, when, through restriction of the carbonaceous intake, the carbonaceous income to the blood is reduced. The case was, of course, physiologically prepotent to a marked degree.

CASE IX.—*Recurrent bilious attacks originally pre-menstrual only, later inter-menstrual also. Complete relief by diet. Under observation 7 months.*

Mary O'R——, aged 35: fairly nourished, but somewhat anaemic: single: domestic servant.

Since puberty at the age of 16, has suffered from a bilious attack just before each menstrual period. For a time, the attacks were limited to these occasions, but they have gradually increased, both in severity and frequency, until for the last six months she has suffered once and sometimes twice a week. She has also suffered from insomnia and from almost constant dyspepsia.

The attack invariably begins during sleep. She awakes with diffused headache: no visual symptoms except increased pain on using the eyes. Vomiting of bilious fluid always occurs at once or an hour or so later: this is rapidly followed by relief from all symptoms.

Her customary diet was bread and butter with tea, three or four times daily: twice or thrice a week she had meat for dinner.

She was ordered meat three times daily, green non-starchy vegetables, toast restricted to two ounces daily with butter. A week later, she was losing in weight and complained of muscular weakness in the legs. Accordingly toast was increased to three ounces daily and a small plate of porridge and milk was allowed before breakfast.

On this diet, the bilious attacks rapidly gave way in frequency and severity. Vomiting ceased from the start. Three months after the commencement of treatment, she had only had two slight attacks. Her colour had greatly improved; her health was excellent, she had gained greatly in energy, and her work, which she was on the point of abandoning, had become a pleasure: insomnia and dyspepsia had disappeared.

Six months later, she continued in the same improved condition: her anaemia had quite disappeared.

Remarks.—The commencement of recurrent neurosal acarbonizing processes at puberty, their limitation for a time to the immediately pre-menstrual period, and their subsequent occurrence at

more frequent intervals, is an extremely common history. The case was a very common one in all its features, and presented none worthy of special note.

CASE X.—*Typical periodic migraine, completely dispersed by moderate restriction of the carbonaceous intake. Under observation 4 years.*

Mrs. B—, aged 35 : weight 13 stone 10 lbs.

Fifteen years ago, immigrated to Queensland from Ireland. Shortly after her arrival in the colony, commenced to suffer from periodic headaches. With the exception of one period of nine months spent in England, she has never since gone more than three weeks without an attack up to October 1899.

Description of attack.—Wakes in the morning with unilateral headache and inability to read through haziness of vision with sense of rapid motion. The pain commences at one definite spot in the temple and gradually extends until it covers the corresponding half of the scalp : the eyeball on the affected side is especially painful. Sometimes the pain commences in the occiput and extends forwards and upwards, always however remaining unilateral : it is intensely throbbing in character. The right is the side usually affected : sometimes the left : never both simultaneously. During the attack *hyperesthesia* of the affected side is sufficiently severe to prevent her from combing her hair : this symptom persists for a day or two in diminished degree after the cessation of the pain. Vomiting of bilious fluid comes on about two hours after rising in the morning. After this she feels better in all respects except as regards the headache : this persists for two or three days, gradually wearing off, but maintaining to the last its one-sided character. During winter or even during a spell of cool weather, she suffers from the above symptoms, but vomiting is then absent.

She has had varied treatment from different medical men. All her decayed teeth were completely removed. She has been measured for glasses which she has worn consistently for some years. She has taken much phenacetin, antipyrin, etc., etc. No benefit, so far as the periodic headaches were concerned, accrued from any of these therapeutic measures.

In October 1899, she came to me for treatment of her obesity : she had abandoned treatment for headaches. She was dieted for obesity : protein was increased : fats and sugar interdicted : starch foods reduced to two ounces per diem. No other alteration in her daily life was made.

To this diet she adhered strictly for six months, at the end of which time she had fallen in weight to below 11 stone. Throughout the whole period she had no trace of headache of any kind, nor any

migrainous symptom. But she had now gained the desired reduction in weight, and therefore returned to her ordinary mixed and somewhat generous diet. At the end of a fortnight, she had a typical attack of migraine, identical in all respects with the attacks described above ; and these have continued to recur at their old intervals about every fortnight or three weeks. She is, of course, well aware that she has it in her power to avoid them, but she prefers the intermittent punishment to the continuous dietetic restriction. She has regained her previous weight or nearly so.

More recent dietetic experiments in this case showed that a carbonaceous restriction, considerably less severe than that which was required to cause marked loss of weight, was quite adequate to keep her free from headache.

Remarks.—This case was clearly one concerning which it might be said that the periodic neurosal attacks constituted ultra-physiological or pathological reinforcements of physiological acarbonization which was inadequate to deal with the excessive supply. And since the restriction of supply necessary to abolish the demand for such reinforcements left all the physiological needs of the body amply satisfied, the case must be regarded as physiologically prepotent. In such a case, were the acarbonizing paroxysms abolished by striking out some essential factor other than humoral, such as, say, the correction of ametropia, it is highly probable that hyperpyraemia would become exaggerated. There might then eventuate some alternative pathological acarbonizing process, for example, acute gout, or even a condition of unrelieved hyperpyraemia.

CASE XI.—Severe bilateral migraine. Complete relief during continuation of diet and exercise. Under observation over 4 years.

Miss G——, aged 24 years : weight 7 stone 4 lbs. : thin and rather anaemic.

Has suffered violent recurrent sick-headaches for the last ten years. For the last year, they have recurred every alternate Friday : for the last month, every Friday. They commence in the afternoon, persist through the whole of Saturday, and terminate at midday on Sunday. Thenceforward, there is no pain, but she remains shaky and as if convalescent from a severe illness until about midday on Monday.

The pain affects the whole of the cranium, but is especially severe in the frontal region. Both angular arteries are visibly dilated and pulsate violently : pressure thereon removes the worst pain for the time being. When the pain becomes very intense, she is sometimes hysterical and has occasionally fainted. She has no visual symptoms except haziness of vision during the pain. She always has complete

anorexia, sometimes nausea, and occasionally vomiting. The last gives much relief, so much so that she usually endeavours to promote it.

Four years ago she was measured for spectacles, as her attacks were ascribed to an error of refraction. Her glasses have been altered on several occasions since. At each alteration, she experienced some benefit which, however, rapidly wore off. During her attacks, the surface of the body is cold and anaemic: yawning is a common premonitory symptom. The headaches have never had any connexion with menstruation. She has never had any sign of dyspepsia: her appetite has always been good and her digestion powerful. Her diet has been a generous mixed one containing ample meat: she is addicted to eating between meals.

On March 26, 1900, she was dieted as follows:—

Breakfast.—Four ounces of proteid in the form of lean meat, fish, or eggs. Half an ounce of toast with very little butter. Tea without sugar but with a little milk.

Dinner.—Six ounces of proteid: half an ounce of toast: green non-starchy vegetables, about four ounces, a baked apple or two.

Tea.—Similar to breakfast.

She was directed to take three to five miles' walking exercise daily or its equivalent; also to sleep with all windows and the door open.

The Friday following the commencement of this treatment was the expected day for an attack. This anticipated attack occurred, but was modified as follows:—Slight general headache on rising, ceased absolutely at 10 A.M., leaving her quite well. The same happened on Saturday, Sunday, and Tuesday. There was no further headache until April 18, when she had a slight one lasting three or four hours only. On May 7, there had been no trace of headache, a period of eighteen days since the last slight one. On May 8, there was slight general headache during the forenoon and afternoon. On May 9, an attempt was begun to increase nutrition. She was ordered two or three ounces of butter per diem, cream in her tea, also three pints of milk per diem; while proteid was reduced to ten ounces per diem. During the following week she had a slight attack, but none besides until Saturday, June 2. On this day she awoke with severe pain, more occipital than usual: this gradually increased, was accompanied by vomiting, and did not cease until Sunday afternoon. Ordered to reduce largely butter and cream.

On June 29, her weight, which had fallen to 7 stone 1 lb., had risen again to 7 stone 9 $\frac{1}{4}$ lbs., but she had had several morning headaches and one distinct migraine. She was ordered back on to her original strict diet.

September 14.—She had a slight headache lasting four hours

on July 18: a migraine lasting twenty-four hours on August 4; and the same on August 28. None of these attacks was followed by any prostration at all, nor was there any vomiting: on the cessation of the pain she felt quite herself in all respects. She admits having eaten cake at times: also some sweets, and strawberries and cream. These indiscretions preceded each attack by from three to five days.

On September 22, she had a severe attack of migraine: she admits having taken strawberries and cream almost every day for a week previous.

After this, she determined to avoid all extra articles of diet and to adhere rigidly to her daily scale, which was now as follows:

One quart of milk.

One ounce of toast with a full teaspoonful of butter.

Twelve to fifteen ounces of lean meat, fish, or poultry.

Green non-starchy vegetables *ad lib.*

Two baked apples: sometimes in addition one uncooked apple.

To the above on October 16 was added a small baked custard made from one egg and half a pint of milk.

On this diet, she remained absolutely free from migraine until May 29, 1901, that is to say, a period of 243 days, suffering only on two occasions from slight morning headache which passed off after breakfast. During the whole time, she remained in robust health and took a large amount of exercise. She was in Sydney during the Commonwealth celebrations, and was on her feet from 7 A.M. to midnight, tiring out the majority of her friends sight-seeing. Later, she went to the hills and did much climbing. Her weight had increased to 8 stone.

At the end of this period, she returned to Brisbane. She had now proved to her own satisfaction that she had it absolutely in her own power to avoid migraine altogether. She was, however, naturally very tired of her dietetic restrictions and anxious for greater variety. The further course of the case consists of a series of experiments, undertaken with her full sanction, to try and find out what variations could be made without inducing headache. It cannot be said that, up to March 1904 these experiments were in any material degree successful, almost all departures from the strict diet scale being shortly followed by attacks. Thus one teaspoonful of glucose daily led up to a severe migraine in about a week: an extra pint of milk per diem had a similar effect; and an increase of fruit or butter was followed by the same result. A small plate of porridge and milk before breakfast was followed on one occasion by migraine, on another by a smart attack of diarrhoea. On April 14, 1903, she was ordered nitro-glycerine $m \frac{1}{100}$ thrice daily; and toast was increased at

first to two ounces, later to three ounces, daily. On April 30, she had had no attack and her weight had increased from 7 stone $4\frac{1}{2}$ lbs. to 7 stone 8 lbs. The nitro-glycerine was then increased to four times daily and the toast to four and a half ounces. A week later, however, she had a migraine and the experiment was abandoned.

In March 1904, I sent her to Dr. W. N. Robertson in order to try if anything could be done intranasally. He reported that there was enlargement of both middle turbinateds, which entailed decided pressure by these bodies upon the septum. The case was then handed over to him for treatment: he proposed to relieve the septal pressure by cauterization of the enlarged turbinateds.

Remarks.—The results of relieving the septal pressure by operative measures will be of extreme interest as regards the special combination of factors which in this case led to migraine. The indispensability of the humoral factor has been already demonstrated by the fact that by restriction of the carbonaceous intake and increase of the carbonaceous expenditure through physical exercise, cool weather, and increase of proteid, the attacks could be completely prevented for long periods together; and by the fact that any interruption of these conditions was quickly succeeded by relapse. The indispensability of the factor of intranasal pressure has yet to be demonstrated.

CASE XII.—*Severe recurrent migraine of thirty years' duration. Partial relief from diet irregularly carried out. Under observation 6 months.*

Mrs. G —, aged 43: weight 8 stone 1 lb.: spare of frame: manages a large boarding establishment: consequently is much occupied with domestic duties, and is out very little.

Has suffered from recurrent headaches for at least thirty years. At puberty and for the succeeding eight or nine years, the attacks were limited to the menstrual period, always commencing on the day preceding the flow. Later, they recurred more frequently, about once a fortnight, and quite recently, as often as once a week or even more frequently. During her two pregnancies and the lactations which followed, a continuous period of thirty-six months, she experienced complete relief from attacks. *This was the only period during thirty years that she ever went for more than five weeks without an attack (compare § 320).*

The attack commences nearly always on Saturday afternoon, during the early part of which day she feels particularly well. Slight pain begins in the occiput: this gradually increases in intensity and extends to the vertex, which becomes very hot, both subjectively and objectively. Two or three hours later, very severe pain, throbbing in

character, attacks the right eyeball, and the skin over the inner part of the corresponding eyelid becomes dark in colour. The sight of this eye is affected : she sees black motile specks, but only while the headache is present. The whole of the right half of the cranium is affected. Occasionally, the pain has extended down to the right shoulder-blade. This part then becomes hot and red, and affected with the same distensile sensations experienced in the scalp and eyeball. While the painful areas are always hot, the general surface of the body is on the contrary intensely cold. The whole attack lasts until Sunday evening and subsides during sleep, a period of about thirty-six or forty hours. Vomiting, at first of white froth, later of bilious fluid, takes place on Saturday or Sunday. The affected side of the scalp is very tender, and this tenderness persists for two or three days after the attack is over. The radial pulse is constricted and somewhat increased in frequency (96). During the early days following the attack, she is at her best.

Towards the end of the attack and on the succeeding day, she passes a large quantity of pale urine. Occasionally, she has noticed that this polyuria is succeeded for a day or so by red urinary deposits.

She was measured for spectacles which she wore for two or three months. She thought at first she obtained some relief, but if so it was merely temporary.

She has always had a remarkably good appetite and a strong digestion : nothing ever seemed to disagree with her, but, as her friends said, 'her food never seemed to do her any good,' i.e. she never increased in weight. Her teeth are in excellent condition : her bowels have always acted regularly without medicine.

Her food habits were somewhat as follows :—

6.45 A.M. Tea with bread and butter.

8.30 A.M. Meat, bacon or fish, toast and bread and butter, marmalade, tea without sugar.

11 A.M. Tea with bread and butter.

1 P.M. Cold meat and salad : bread and butter.

4 P.M. Tea and cake.

6.15 P.M. Meat and vegetables : stewed fruit and custard : dessert.

10 P.M. Biscuit and glass of wine : in winter, cocoa and biscuit.

Treatment was commenced on April 3, 1900. She was directed to abstain from all interim meals, and replace them by hot water or hot weak tea. All fats, sugar, and starch foods to be omitted, except one small piece of toast per diem ; and to take thrice daily a meal consisting of fish or lean meat of any kind (except pork, goose, and duck) with green non-starchy vegetables, and a little of the less saccharine fruits, such as baked apples, rock melon.

Her history for the following seven months may be thus summarized:—

April 4. Severe attack : duration 36 hours.
„ 11. Moderate attack : duration 36 hours.
„ 28. Very severe attack: duration 40 hours.
May 2. Severe attack : duration 36 hours.
„ 16. Moderate attack: duration 24 hours.
„ 31. Severe attack : duration 28 hours.
June 23. Moderate attack : duration 36 hours.
August 18. Severe attack : duration 40 hours.
September 28. Severe attack : duration 40 hours.

On the whole, the attacks have been milder, and have left her much less prostrated than before. The intervals between the attacks have steadily increased : from an interval of three or four days at the commencement of treatment, an interval of forty-one days was attained. Certain modifications in the symptoms of the paroxysms succeeded dieting. Vomiting ceased immediately and never recurred : latterly nausea was absent, though anorexia persisted. While polyuria continued, uratic deposits ceased. The paroxysm, which took place on May 16 and which is noted as of only moderate severity, was *left hemicranial*, for the first time in the history of the case. During the first three months of treatment, she suffered occasionally from slight right hemicranial pain, commencing in the morning and passing off in an hour or so. Coldness of the surface has been much less intense since the treatment began. Her general health, physical and mental, has improved : she is conscious of a great increase of energy. Her weight has remained stationary.

Remarks.—The result is disappointing ; but it is only fair to say that it does not represent what might have been attained, had the dietetic restrictions been enforced. Here, as commonly happens in migraine cases, the patient was too readily satisfied with her improved condition, and constantly broke down in her observance of the dietetic rules. Thus she admits that, for ten days before the attack on August 18, she had been taking an ordinary mixed diet ; and the same for two or three days before the attack on September 28. She confesses too that she frequently departed in lesser degrees from the rules, throughout the whole course of treatment. Her occupation precluded physical exercise to any useful extent.

CASE XIII.—*Recurrent migraine, relieved by diet and exercise.*

B. W—, aged 40 : son of Case VII : dark, thin, and of ‘biliary temperament.’

Has suffered from migraine for many years : lately, as often as once a month and this regularly. He has never suffered from any

form of indigestion, and can eat anything. He is in business and has not time for much exercise. He has been accustomed to eat heartily thrice daily, under the idea of keeping up his strength and getting a little fatter.

He was ordered to take as much exercise as possible short of fatigue; also to cut down his diet as low as possible, reducing especially sugar and starch foods. Only these general instructions were given.

Three months later he had had only one slight attack.

CASE XIV.—*Recurrent migraine relieved by moderate carbonaceous restriction.*

Annie E—, aged 15: anaemic.

Her father has been a lifelong sufferer from migraine, to which has been superadded of late years chronic renal disease with considerable albuminuria and extremely high blood-pressure.

She herself began to suffer from migraine two years ago. For the last few months, there has been an attack every week: this begins on Thursday evening, lasts through Friday, and is gone on Saturday. The part mainly affected is the right eyeball, where the pain remains fixed: she has complete anorexia but never vomits. Her customary diet, according to her father, consists of 'bread and butter, six times daily, with weak tea, milk, and much sugar.' She is greatly addicted to 'lollies.'

She was dieted by excluding sugar, reducing starch-foods and fat, and increasing proteid. Three months later her father wrote saying she had had only one or two mild attacks, although her attention to the prescribed dietary had not been by any means strict.

Remarks.—Though hereditary, this case was readily amenable to treatment by diet. The favourable circumstances were probably (1) the fact that her ordinary diet was grossly unphysiological; (2) her youth; and (3) the comparatively recent onset of the affection.

CASE XV.—*Recurrent migraine indeliberately dispersed by house-work.*

Mrs. Q—, aged 40.

This lady called upon me in connexion with an illness of one of her children. In the course of conversation, however, she gave me a part of her medical history, which is, I think, worth recording. For six years, until one year ago, she suffered from migraine recurring regularly every three weeks: she described the attacks, and they were undoubtedly typical, though not very severe. About a year ago she lost her general servant and was unable to obtain the services of another. She accordingly did all her own housework. While

working she improved very greatly in health and enjoyment of life. Consequently, she ceased to trouble about a servant and has continued to work ever since. *Her migraine has absolutely ceased.*

CASE XVI.—*Recurrent migraine complicated by daily occipital neuralgia. Relief by diet and increase of physical exercise. Under observation 2 years.*

Edward G—, aged 40 : height 6 ft. : weight 13 stone 4 lbs.

Has suffered from recurrent bilious attacks or migraine for nineteen years, that is, since he gave up athletics at the university. For the former two years of this period, he kept a horse, and then he suffered only occasionally. For the latter seventeen years, the attacks have been more frequent, about every three weeks and nearly always on Sunday. During the last year, he has suffered in addition from left occipital neuralgia, at times every day : *for the last six weeks, he had been affected every night.* His appetite and digestion are good : he takes very little exercise, most of his leisure being devoted to reading.

March 27, 1902.—Diet, twelve ounces meat, fish or eggs : three ounces of bread or potatoes : green non-starchy vegetables : apples two : a little butter : one pint of milk : tea and coffee. He lived about two miles from town and he was ordered to walk to, and from, his office.

March 30.—Migraine attack due to-day (Sunday). It came on as usual about 9.30 A.M. Instead, however, of lasting until bedtime as usual, it disappeared about noon. N.B. He has little loss of appetite during these attacks, but he does not eat because his experience teaches him that about half an hour after taking food his headache becomes very greatly exaggerated and he suffers from palpitation.

No neuralgia since commencing treatment.

April 7.—A tendency to sick-headache, coming on in the afternoon : he walked it off by the evening. He had during the week a mere hint of neuralgia lasting one hour.

April 24.—Slight return of neuralgia this afternoon : no migraine.

May 2.—One slight attack of neuralgia : no migraine.

Subsequent history.—The tendency to neuralgia quite disappeared, but he continued to suffer from occasional attacks of migraine. These however, he could always trace to some slight excess of food or to deficient exercise.

Remarks.—Migraine attacks which are associated with complete loss of appetite for a day or so tend as a rule to be regularly recurrent and to remain uncomplicated by neuralgic or other affections depending on hyperpyraemia. In this case, it is improbable that the migraine attacks promoted efficient acarbonization, since anorexia

was absent; hence, probably, the development of the neuralgic complication.

CASE XVII.—*Recurrent migraine of lifelong duration. Relief from diet, but treatment abandoned on account of loss of weight and debility. Under observation 3 months.*

Mrs. E. W—, aged 48: weight 7 stone 1½ lb.

She has suffered all her life from migraine at frequent intervals: the pain is right and left hemicranial alternately: during attack polyuria, next day uro-lithiasis.

April 19.—Put upon a small proteid diet with green non-starchy vegetables: bread foods limited to 1½ ounce per diem.

April 24.—She has adhered strictly to the diet: no distinct attack, but several slight threatenings: weight 7 stone: feels very hungry between meals. Ordered half a pint of milk at 11 A.M., 4 P.M., and bedtime.

April 30.—On the 26th she had an attack, which however lasted only twelve instead of the usual twenty-four hours: there was, if anything, more vomiting than usual. The interval of freedom preceding this attack was eleven days: usually it has not been more than seven. Weight 6 stone 13 lbs.

June 6.—Weight 6 stone 8½ lbs.

June 15.—Attack commenced on rising in the morning and lasted until midday on the 16th. She is greatly troubled with haemorrhoids and constipation: the latter is worse since she came under treatment.

July 5.—Has had two slight headaches and a very severe one on the 3rd inst. On June 28 and 29 and on July 1, she had broken rules to the extent of taking a very little cake with afternoon tea.

The further history of this case showed that it was impossible to keep her quite free from headaches without a very severe restriction of her carbonaceous intake—a restriction so severe as to cause progressive loss of weight and distinct muscular weakness: the treatment also intensified the discomfort arising from constipation. It was therefore abandoned.

Remarks.—The case is introduced as an example of pathological prepotency, of which there are many. In such cases, carbonaceous restriction alone is unsatisfactory; but I think a better result would have been obtained had the patient been in a position to take regular physical exercise. The factors of the pathological prepotency were not clear. Eye-strain was not among them. Possibly prolonged recurrence was the main factor.

CASE XVIII.—*Recurrent morning headaches. Rapid and complete relief by merely omitting sugar. Under observation 2 years.*

Mrs. T—, aged 39.

In this case, double ovariotomy had been performed ten years ago. Of late she has awoke every morning early with rather severe frontal and occipital headache, without dyspeptic symptoms or loss of appetite. A series of such headaches has lasted for three weeks.

She was advised simply to omit from her diet sugar and all articles of food containing sugar.

The omission of sugar was succeeded by cessation of all headache at once. Two months later she had had only one headache, and that was on one morning following cake with afternoon tea the day before.

Eighteen months later she continued in good health.

CASE XIX.—*Daily recurrent headaches without loss of appetite : relief from omission of sugar and increase of exercise. Under observation 3 years.*

Miss H—, aged 23 : weight 9 stone 7 lbs. : hospital nurse.

Headaches commenced at puberty (15 years), and have persisted since. She always has a menstrual attack, which commences twenty-four hours before the appearance of the flow and ceases immediately the flow appears. She also has inter-menstrual attacks, sometimes two, sometimes only one. All attacks, whether menstrual or inter-menstrual, are present on awaking : when she is on day duty, this is in the morning : when on night duty, in the evening. Occasionally, the headache leads to vomiting : as a general rule, she has no loss of appetite whatever during a headache.

Of late years, her headaches have been gradually becoming more frequent : during the last eighteen months, she is sure that she has suffered from headaches for half her waking life : the pain wears off towards the evening or towards the morning, according as she is on day or night duty. The pain is always frontal.

She has always had a large appetite and has never to her knowledge suffered from indigestion. She dislikes meat and is very fond of pastry, cakes, sweets, etc.

She was advised to omit from her diet sugar and all articles of food containing sugar ; also to take as much exercise as possible.

This treatment she carried out in a very half-hearted manner in both respects. Nevertheless, her headaches diminished by about 75 per cent. During one month she suffered from her menstrual attack only, and this was of but moderate severity.

Remarks.—There can be no doubt that the almost complete absence of acarbonizing anorexia was responsible in this case for the frequency and continuousness of the headaches.

CASE XX.—*Post-prandial headaches. Rapid and complete relief by exercise and moderate restriction of the carbonaceous intake. Under observation 1 month.*

James H—, aged 21 : weight 9 stone $13\frac{1}{4}$ lbs.

Has suffered from headaches during the last four years, that is, from about the time he commenced office work. For the first two or three years, the attacks were associated with complete loss of appetite and vomiting : then they occurred only once a week or even only once a fortnight. In January 1903 he came from Adelaide to Queensland : since then, he has had attacks at least twice a week, not infrequently every day. Since they have been so frequent, they have been quite unassociated with digestive symptoms. He has never suffered from indigestion or discomfort after meals. Usually, the headaches have begun after breakfast, wearing off towards the late afternoon ; but quite lately they have begun after lunch and lasted to bedtime. The pain affects the forehead just over the eyes, which are very bloodshot : when the pain is very bad, his hands and feet are cold, sometimes damp.

March 10, 1903.—Ordered to walk to and from office, a distance of three or four miles in all, twice daily. Diet : meat, fish or eggs at each meal : avoid sugar : bread, three ounces daily : half-pint milk between meals

March 14.—Has had two headaches, same as usual.

March 17.—Is no better. Both diet and exercise irregular : careful observance insisted upon.

March 28.—No trace of headache since last note, until this morning, when he had slight 'fullness of the head.' Last night he ate a late supper, having missed his evening meal. Bread increased to four ounces daily.

April 11.—No trace of headache until yesterday. Yesterday being Good Friday, he had a midday dinner and, instead of going to work as usual, fell asleep : two hours later, he awoke with headache. He has slightly increased in weight since commencing treatment. Weight 10 stone and 2 ounces. He looks and feels much better in every way and is conscious of a material increase in strength and energy, physical and mental.

Remarks.—It is easy to follow cause and effect in this case, which is a typical example of post-prandial hyperpyraemic headache. The deleterious influence of sleep after meals, and the conservative influence of anorexia, stand out clearly.

CASE XXI.—*Intense post-prandial drowsiness. Immediate relief by restriction of the carbonaceous intake at breakfast. Under observation 2 years.*

Robert H—, aged 28 : hospital resident medical officer.

Had always been extremely thin. He came to Queensland because, having suffered from haemoptysis, he was supposed to be suffering from incipient tuberculosis of the lungs. There were, however, no conspicuous physical signs.

He consulted me on account of insuperable sleepiness coming on every day after breakfast and lasting for an hour and a half or two hours. Shortly after that meal, he would begin to yawn and become apathetic and quite unfit for his work. Whenever he had any special work to do, such as assisting at a major operation, he was obliged to omit breakfast and take a cup of tea only. The weather affected him greatly. His symptoms were always much more marked in summer: on the other hand, they were sometimes nearly absent in cold weather. Also they could be prevented or dispersed by a sharp walk. *He never suffered from any true dyspeptic symptom.*

Being very thin, he had deemed it expedient to take a large quantity of fattening food. His ordinary breakfast consisted of oatmeal porridge with sugar in plenty and milk, followed by bacon, eggs, toast, marmalade, etc.

Sugar and porridge were cut off, chop or steak with moderate amount of toast being substituted. His symptoms ceased on the day his diet was altered.

Remarks.—There can be little doubt that the post-prandial symptoms in this case were due to the sudden intrusion into the general circulation of carbonaceous material in excess of the patient's capacities for physiological disposal. Fat-formation, which with most persons probably takes an appreciable share in post-prandial decarbonization, was manifestly deficient in his case, while combustion, unless exaggerated by physical exercise or cold weather, was presumably inadequate. The symptoms of post-prandial hyperpyraemia are far commoner after the midday meal than after breakfast. Usually, it would appear, the rapid combustion of the forenoon is a sufficient safeguard. The case illustrates the futility, if not the danger, of increasing supply in the face of deficient function.

CASE XXII.—*Post-prandial drowsiness and depression: obesity: acne. Complete relief from all three under a lean meat diet: concurrent marked improvement of myopic vision. Under observation 4 years.*

P. M—, aged 42: weight 14 stone 4 lbs.

Had been increasing in weight rather rapidly until quite lately. Complained of feeling very drowsy in the early morning but more particularly after lunch, at which time he would feel extremely tired and unfit to continue his work. He was also depressed at the latter time, but would begin to 'brighten up' about two hours later. He

ascribed his condition to overwork in his office and deficient exercise. His appetite was excellent, and he had never to his knowledge suffered from any form of dyspepsia.

He was put upon a mainly lean meat diet, with very little carbohydrate and fat.

This patient, however, was a 'too willing' one. I found that for some weeks after I prescribed for him he had been living practically upon a Salisbury diet; and that he had taken as much as 3 lbs. per diem of finely minced beef.

In two months, his weight had fallen to 12 stone: his symptoms had disappeared within the first week; and he was conscious of a considerable increase of physical and mental energy.

I had asked this patient, who was highly educated and observant, to take special note of any alteration in his symptoms and general condition. Three days after commencing treatment, he informed me that he thought his distant vision had improved (he was myopic). A fortnight later, he had no doubt whatever upon this point. He was then able for the first time without glasses to read the name on a tramcar in time to signal it to stop. He had also suffered to a slight extent from acne of the nose: this quite ceased within a fortnight.

Having obtained the desired reduction of weight and relief of symptoms, this patient returned to his original rather generous mixed diet. His weight again rose, and two years later he had an attack of renal colic and passed a small uric-acid calculus.

Remarks.—The improvement of distant vision has been referred to in the body of the work (§ 793): such is difficult to explain.

CASE XXIII.—*Recurrent pre-menstrual and post-menstrual headaches. Complete relief by carbonaceous restriction and physical exercise. Under observation 3 years.*

Mrs. K—, aged 41: weight 8 stone 10 $\frac{3}{4}$ lbs.: three children.

Always subject to slight occasional headaches, except for a period of eighteen months which she spent in the South of France among the hills: she was then under twenty, and got 'enormously fat': her headache came back on returning to London.

Fifteen years ago, after the birth of her second child, she commenced to suffer from severe hemicranial headaches. So severe were they that she was at times irresponsible and has frequently contemplated suicide: on one occasion she took an ounce bottle of chlorodyne, which fortunately made her vomit. These headaches ceased through her third pregnancy and returned after her third confinement.

The hemicranial pain commences from three days to a week before her menstrual period, ceases as a rule during the flow, and

returns just after the end of the flow, lasting three or four days thereafter. Her appetite is only very slightly impaired during the attacks. She always makes a point of eating conscientiously through the attacks, as she has been advised to do, in order to keep up her strength. Her appetite is generally very good: her digestion has always been good, except during the last month, when she has had occasional heartburn, and during her last pregnancy, when, as already said, she was quite free from headaches.

She suffers also from an almost constant sensation of weakness in the cervical spine, especially after sitting upright for a time: this is worse during the menstrual period: she uses a small specially made cushion for support.

She has undergone for years a prolonged course of gynaecological treatment, including curettage, intra-uterine injections, vaginal plugs and douches, combined with complete rest during each period. Dr. W. S. Playfair examined her and told her that there was nothing the matter with the ovaries, tubes, uterus, or pelvic organs. He suggested the Weir-Mitchell treatment and almost promised a satisfactory result, but she was unable to remain in London at that time. Menstruation regular but rather profuse.

Her habitual diet is as follows. Breakfast: bacon with a good deal of bread: bread and butter: tea with milk and sugar (two lumps). 11 A.M. a banana. 1 P.M. meat, potatoes and other vegetables: a little bread. 6.30, meat or fish: bread and butter, jam, cake, etc.: tea with milk and sugar.

June 26, 1902.—Organically sound: uterus rather large, in good position, cervix lacerated, slight tenderness in left fornix.

Treatment.—Diet: meat or fish twelve to fourteen ounces: bread three ounces, with butter: green non-starchy vegetables: two or three apples: one pint of milk, half at 11.30 A.M., and half at 4.30 P.M. Walking exercise to be taken in the morning, afternoon, and especially in the evening.

July 5.—Weight 8 stone $9\frac{1}{3}$ lbs. No headache, although several days overdue: is very hungry, but has not felt so well for years.

July 9.—Period began this morning: it is a day late. No headache: *this is the first time for sixteen years that menstruation has come on without any headache.* Weight 8 stone $7\frac{1}{3}$ lbs.

July 15.—Period ceased yesterday: no headache during or since: Only on one occasion has her period ceased without a headache coming on. Has only walked once daily during period. She has felt weak and tired, but much less so than during previous menstruations. She sleeps better, but wakes earlier. Weight 8 stone $6\frac{1}{8}$ lbs.

July 24.—Caught cold in head on the 20th: this was associated with some return of her accustomed hemicranial pain: the pain

ceased yesterday, though the catarrh persists. Bread at breakfast increased to $1\frac{1}{2}$ ounce (i.e. $3\frac{1}{2}$ ounces per diem).

July 29.—Weight 8 stone $4\frac{3}{4}$ lbs.

August 6.—Weight 8 stone $3\frac{1}{2}$ lbs. Menses began on 31st ult. three days before due: ceased August 5, less profuse than usual: no headache at all.

August 14.—Weight 8 stone $1\frac{3}{4}$ lb., no headache: tired after walks.

August 22.—Slight headache began on 15th: lasted three days as usual: it was very slight and she was not otherwise indisposed.

August 28.—Menses began August 24, nearly over now: about two-thirds usual quantity: no trace of headache: weight 8 stone $2\frac{1}{2}$ lbs.

September 11.—Weight 8 stone $2\frac{1}{4}$ lbs.: very slight headache on the 8th and 9th inst.

October 10.—Weight 8 stone $\frac{1}{2}$ lb.: very slight headache on 18th, 19th, and 20th. She has quite ceased to suffer from the sensation of weakness in the cervical spine.

The further progress of this case was altogether satisfactory. She has remained for many weeks at a time without any trace of headache: then she would transgress somewhat in the matter of food and exercise, and a slight pre-menstrual or post-menstrual headache would recall the necessity for care. Thereafter, she would return to strict treatment for a time and remain free.

Note made in October, 1903.—Remains well.

Note made in April, 1904.—Remains well.

Extract from letter from husband in October 1904.—‘Mrs. K—— continues to enjoy good health. It seems to me that the absence or presence of headache depends upon following or not following the diet you prescribed for her.’

Remarks.—There are several points of special interest in this case. The purely menstrual incidence of the hemicrania led, as it so often does, to prolonged useless, expensive, and distasteful gynaecological treatment. The almost complete absence of conservative anorexia during the attacks was undoubtedly the cause of their prolonged duration, and this was still further increased by overfeeding at the time. The influence of restriction of the carbonaceous intake and increase of the carbonaceous expenditure by exercise was well shown upon the amount of the menstrual loss, as well as upon the hyperpyraemic headaches.

CASE XXIV.—*Daily headaches without loss of appetite: relief by exclusion of sugar.*

Emma B——, aged 32 years.

She is very thin and her occupation very sedentary: she has for the last five years been engaged in attending to an epileptic child.

During this time, she has had almost constant headache without the least loss of appetite. Her digestion has always been good and her appetite large. She indulges largely in sweets.

Exclusion of sugar from her diet, without other change, reduced her headaches from five or six per week to one a fortnight, and that one was only slight.

Remarks.—Such cases are very common. They are often treated by change of air and occupation : this is frequently successful, in part because it generally involves an increase of exercise. In most cases it is not enough merely to exclude sugar.

CASE XXV.—*Frequently recurring headache of irregular duration. Complete relief by moderate dietetic restriction.*

Dr. W. N. R——, aged 38 : tall and thin.

He has suffered severely for the last fifteen years from frequently recurring headache, which he ascribes in the first instance to hard reading and want of exercise : later, to overwork and want of sleep ; and for the last three or four years, mainly to want of exercise. He obtains considerable relief from aperients : if he omits their use, the headache is liable to persist for a fortnight at a time. The pain is intense in either temple, but extends to the corresponding shoulder and as far as the lower ribs. During a paroxysm the face is pale, but the temporal arteries are visibly dilated.

He is a Scot : is fond of, and takes, porridge, cakes, marmalade, puddings, etc. A large consulting-room practice precludes much physical exercise.

His diet was altered : porridge, puddings, sugar in all forms, etc., were cut off ; and he was advised to restrict the amount of bread. Meat, fish, eggs, were necessarily somewhat increased.

As a result, he ceased at once to suffer from headaches and remained absolutely free for between two and three months. Then he had an attack which he admits followed a gross breach of the above dietetic rules. He is now able to take porridge, bread in moderation, junket, most fruits and custard with impunity. He has refrained from liquids at meal times and finds his digestion much improved thereby.

Remarks.—It seems highly probable to me that the diminution in the amount of carbohydrates and the consequent relief from glyco-genic distension of the liver were factors in the improvement of digestion at least as important as the abstinence from fluids during meals : in other words, I believe this patient's dyspepsia was very largely a secondary dyspepsia.

CASE XXVI.—*Recurrent sick-headaches : recurrent epistaxis : double oophorectomy : rheumatoid arthritis with menstrual exacerbations : dry bronchial catarrh : obesity. Under observation 6 years.*

Mrs. M. L—, aged 40 : weight 15 stone. Has all her life had an excellent appetite and a strong digestion.

As a girl she suffered from fairly regular sick-headaches recurring every fortnight, three weeks, or month. For a year or so, while at boarding-school, these ceased, and during that time she had very frequent bleedings from the nose. Thereafter the sick-headaches recurred with their old regularity, but became very slight during her three pregnancies, ceased during a long illness (septic) which followed her last confinement, and returned thereafter.

In 1897, she underwent the operation of removal of both ovaries and tubes for old-standing adhesions which caused constant pain. Up to this time, she had been very slight, indeed thin. After convalescence from the operation, she put on weight rapidly and her headaches became few and far between.

In 1898, she visited England, and while there suffered from a mild, but quite distinct, outbreak of rheumatoid arthritis affecting both knees, both elbows, and one thumb. It is, perhaps, significant that for about two months before the arthritic complication, meat had been markedly deficient from her diet. She had been living in London lodgings and taking her meals, which consisted chiefly of tea, bread and butter, and confectionery, at irregular hours at restaurants. For a time, the pain in the knees was severe, especially at night and when sitting near the fire: it was also rendered markedly more severe by a course of hot-bathing at Harrogate. She later consulted Dr. A. P. Luff, who confirmed the diagnosis. The rheumatoid outbreak was preceded by exacerbation of the sick-headaches, which quite ceased during the arthritic trouble.

The arthritis continued without improvement for about five months, when she returned to Australia. Then she went upon a modified meat diet. Under this her weight came down and the joint trouble abated. In the course of a few months, the joint pains entirely ceased except during her menstrual periods, which had continued regularly since the operation. At each menstrual period there was a recurrence of pain and heat in the knee-joints.

About a year later, the menstrual exacerbations of arthritic pain ceased altogether; but about the same time she again began to suffer from periodic sick-headaches. Later, the menstrual losses ceased and she again began to increase in weight.

During the last twelve months, her sick headaches have become milder and less frequent, and she has commenced to suffer from dry bronchial catarrh, with a little wheezing during the small hours. Her joints have remained free from pain, but careful examination

disclosed some marked loss of polish on the posterior surfaces of the patellae.

A moderate degree of restriction of carbohydrates relieved the bronchial symptoms, and she is now practically well in all respects, though corpulent.

Remarks.—With perhaps the exception of the recurrent sick-headaches which affected her in youth when she was thin, it is noteworthy that all the heterogeneous manifestations of hyperpyraemia from which this patient suffered were comparatively mild and readily yielded to a very moderate degree of restriction of the carbonaceous intake. The case may thus be classed as physiologically prepotent. She was conspicuously endowed with a rapid fat-forming capacity; and it seems probable that the glycogenic capacity of the liver was below the average.

CASE XXVII. (Communicated by Dr. A. J. Turner.)—*Periodic, graduating into continuous, headache. Complete relief by restriction of the carbonaceous intake. Under observation 3 months.*

Mrs. W——, aged 47: weight 11 stone 12 lbs.: widow: one daughter, aged 25, one son, aged 24: menstruation still regular: always a teetotaler.

Headaches first appeared about twenty years ago. At first they recurred monthly at beginning of each period: occasionally she would have an attack about midway between two periods; but she never missed the menstrual attack. She thinks that during the headache she used to eat rather less than usual: but there was no marked loss of appetite; nor were the headaches ever sick-headaches.

Ten years ago, the headaches became constant: cannot remember a single morning free from headache: pain continued throughout the day: she was never quite free. At her periods, they would be so severe as to keep her in bed for several days at a time.

In character, the pain was throbbing in both temples and at the back of the head on both sides. She often went about her work feeling half dazed: sometimes the pain was so bad that she felt 'as if she could dash her head against the wall': sometimes she would go cold and clammy, and everything would look red, and she feared she would lose her senses. When at her worst, her face was cold and blue. She has been at times quite dazed and has been aware that people in the street were under the impression she was the worse for liquor.

Apart from headache, has been very strong and enjoyed splendid health: has worked hard: always had a capital appetite.

Had no treatment till seven years ago. Treatment has given no relief: has had antipyrin, bromide of soda, etc. Never suffered from constipation.

May 21, 1902.—Dieted according to Dr. Hare's plan. Relief within a week : at the end of a month, headache had disappeared.

On July 3, had a bad headache reminding her of old times, but it only lasted one day : cannot account for the attack : had not deviated from the diet scale.

On August 9, had influenza accompanied with a headache for three days.

August 26.—Free since then : weight 11 stone about.

Remarks by the writer of this work.—This case well illustrates a very general rule to the effect that hyperpyraemic headaches, unassociated with dyspepsia or anorexia (the acarbonizing features of the attacks), tend to increase progressively and even in the long run to be continuous. Such headaches may be regarded as mere futile attempts at acarbonization, or as manifestations of unrelieved hyperpyraemia.

CASE XXVIII.—*Recurrent diarrhoea : recurrent sick-headaches : uro-lithiasis and renal calculus : obesity. Complete relief of all symptoms. Under observation 4 years.*

Malcolm B——, aged 31 : 15 stone : height 5 ft. 10 ins.

For the last eleven years he had been subject to attacks of severe diarrhoea, coming on without apparent reason at least once a month, but sometimes twice or even more frequently. The attacks lasted about a week and commonly ended with slight dysenteric symptoms : they usually commenced during the night or quite early in the morning. He never suffered from haemorrhoids.

He has also suffered very frequently from uro-lithiasis, that is, from a copious reddish-brown deposit appearing in the morning urine on cooling. He had many of the symptoms of stone in the left kidney, namely, intermittent pain in the region of this organ, greatly intensified by riding or driving, especially over rough roads. This pain had come on at various times for some years, lasting for a few weeks and then disappearing for a month or two. He had never suffered from renal colic. Appetite good : digestion strong. He has always been extremely fond of pastry, puddings, and sweets.

He was anxious to have his weight reduced. Accordingly in April 1899 he was placed upon a mainly fish and lean meat diet : green non-starchy vegetables were allowed *ad lib.* : toast was the only starchy food allowed, and that was cut down to two ounces per diem : two or three apples were permitted ; and he was instructed to drink freely between meals hot water flavoured with lemon juice, and to take moderate, but regular, exercise.

During the course of the next six months, his weight fell to under 12 stone, although it must be admitted that his adherence to dietetic rules was anything but rigid.

Important results, other than the mere loss of weight, rapidly forced themselves upon his attention. During the first three weeks of the treatment, he had one very severe attack of diarrhoea lasting ten days and necessitating the use for a time of a purely milk diet. After this, he had no further attacks of diarrhoea for fifteen months, that is to say, until October 1900. At this time he visited Sydney and for five weeks lived at a first-class hotel. Here he 'let himself go' in the matter of diet: he lived well, in fact, and omitted to take his accustomed exercise. For the first ten days he remained very well. Then he began to suffer from violent frontal headache with anorexia, but no vomiting. These symptoms would pass off about 11 A.M.; but on the following night he would have three or four severe attacks of diarrhoea. Next morning he would wake free from headache and enjoy a good breakfast. This succession of symptoms recurred about twice a week for the three remaining weeks during which he remained in Sydney. They ceased immediately on his returning to Brisbane and resuming a moderately strict diet.

Within a week after he commenced treatment in April 1899, the tendency to urinary deposits quite ceased: the urine remained clear, even on standing for hours. But about two months later, he was seized with violent renal colic: this recurred several times in a fortnight. At the end of this time, he passed a uric-acid calculus, which unfortunately could not be weighed as it became much broken up. Thenceforth the intermittent attacks of pain in the left renal region ceased finally.

Remarks.—This case is an ordinary one in most respects. The fat-forming capacity of the patient, though strong, was seemingly inadequate, without pathological assistance, to preclude recurrent hyperpyrexia: hence recurrent glycogenic distension of the liver, relieved by recurrent diarrhoea, was superadded. The onset of a first attack of renal colic during dietetic treatment may have been a mere coincidence; but it looks almost as if the steady maintenance for a time of a highly solvent urine was instrumental in freeing the calculus. This fortunate occurrence took place also in Case LXXIX.

CASE XXIX.—*Recurrent febricula or recurrent glycogenic distension of the liver with pyrexia. Cessation under restriction of the carbonaceous intake. Under observation 2 months.*

George T—, aged 24: weight 10 stone $2\frac{1}{2}$ lbs.: missionary.

Left Scotland, where he had always enjoyed perfect health, two years ago: he then weighed 10 stone 10 lbs. For the last eighteen months he has suffered from the recurrent attacks specified below. At first the attacks came on once a month: gradually the intervals

became shorter: of late he has suffered on alternate weeks. His appetite was always good, except during attacks.

The attacks begin with depression and irritability on waking in the morning. He feels feverish: his tongue is coated: there is constipation and almost complete disinclination for food. On some occasions he has forced himself to take food: then he suffers from a sense of weight and discomfort but no pain. Each attack lasts seven days.

Dr. Hawkes, who sent this case to me, had seen him during an attack. His temperature was then 99·6° F. but had been higher: his pulse tension was increased, and his liver a little enlarged.

On April 9, 1903, I saw him in another attack. On this occasion his temperature was normal, but he said he had been quite feverish the day before. His pulse was 72, and rather difficult to obliterate: the liver projected two fingers' breadth below the costal margin, but was not tender. There were marked splashing sounds in the stomach, although he had had no food or drink for six hours.

Before I saw him he had been put upon a lean meat diet and his starch foods cut down to three ounces per diem. This was without benefit; but a further retrenchment of his starchy intake to 1½ ounce per diem was completely successful. Two months later he had remained well.

Remarks.—This case exemplifies the influence of warm climates in reducing combustion and thereby leading to recurrent hyperpyrexia and recurrent pathological acarbonization. So long as he remained in Scotland, this patient's carbonaceous intake, though large, was balanced by his carbonaceous output. On coming to Queensland, however, his combustion-rate fell: there then arose an accumulation of carbonaceous material resulting in glycogenic distension of the liver, with consequent acarbonizing anorexia and some slight degree of decarbonizing pyrexia.

But another factor must be taken into consideration. It is probable that while in Scotland this patient took much less meat than while in Queensland, and that, consequently, the digestion and absorption of carbonaceous material (carbonization of the blood) was more complete in the latter country.

CASE XXX.—*Recurrent nocturnal asthma of moderate severity, but of forty-one years' duration: commencing rosacea: complete relief from both affections by moderate dietetic restriction and evening exercise. Under observation 2 years.*

Patrick C—, aged 43: weight 12 stone $\frac{1}{2}$ lb.: a little inclined to corpulence: complexion slightly florid, face showing a few dilated capillaries, especially on the nose and adjoining 'flush area.' Is well built and physically strong.

Has suffered from recurrent asthma since the age of two years : has never been free for more than three months consecutively. He thinks that as he grows older, the attacks are tending to be less severe.

The attacks occur in groups. He will be well for a month or six weeks : then he will be awakened at 3 A.M. and have to sit up until 6 or 7 A.M. When attacked, he usually inhales Himrod's cure, which gives instant relief : the attacks then recur every morning for a fortnight or three weeks. Occasionally he has been travelling when attacked and has been unable to obtain Himrod : *on these occasions, the group of attacks has always worn itself out in three or four days* (referred to in § 340).

Physical examination showed the chest to be free from bronchial complications, and in no way fixed or distorted. On the day of his visit to me (January 27), he had had asthma for the six preceding mornings, and anticipated that in ordinary circumstances he would continue to suffer for about ten days more.

He was ordered the following diet :—

Breakfast : Anything he liked to any amount, excluding only sugar and articles containing sugar.

Lunch : Lean meat : green non-starchy vegetables : one ounce of bread : a baked apple.

Dinner : Clear soup : white fish : lean meat : green non-starchy vegetables : bread, *not more than half an ounce* : alcohol not to exceed two ounces per day. He was also ordered to spend his evenings walking about in the open air, and not to sit in his club as was his usual habit.

January 30.—He has been unable to take any exercise owing to a slight injury to his foot : he has, however, carried out strictly the dietetic instructions. As a result, his asthmatic attacks each morning have been shorter and milder : this morning he had practically none. Weight 11 stone 11½ lbs.

February 4.—No asthma since last visit : weight 11 stone 9½ lbs. To-day he has a sensation of complete freedom of respiration, such as he has not experienced for some months. Last evening he commenced to take exercise : this, however, consisted chiefly in walking round a billiard table.

February 12.—Remains quite well : weight 11 stone 8½ lbs. Eats a better breakfast and feels better, more energetic and younger, than he has done for years.

February 20.—Quite well : weight 11 stone 7 lbs. He says exertion is now a pleasure : he awakes feeling fresh and hungry for breakfast : has not felt so well for years, although he has often been as free from asthma.

March 14.—Remained absolutely well up to March 7. On that day, he adhered to all his instructions until after dinner. He then

deliberately planned an experiment on his own account. He went to a friend's house to a card party : drank whisky about every half-hour ; and finished up with a hearty supper. At 5.30 on the following morning he awoke with a headache and slight asthma. *Although he committed no further indiscretions, the asthma recurred at the same time on the two following mornings* in decreasing degrees.

The result of the experiment satisfied him. As he said, he felt he had his asthma in hand, and that if he suffered any more it would be his own fault.

His complexion had very much improved : all trace of congestion had disappeared : the dilated capillaries were visible with difficulty.

In October 1903, two years later, I received the following information from this patient :—

'Regarding my asthma, I have not remained quite free from the trouble, but it is very much less than formerly, although I have not carried out strictly the rules laid down for my guidance. . . . I find the diet rules easy to comply with, but the exercise after dinner, i.e. after 7 P.M. or between that and bedtime, most difficult to carry out, and I must admit to having failed practically in this. Melbourne is a large city of long uninteresting streets, and walking exercise is anything but pleasant. If I could only find some form of indoor exercise for one hour or so after dinner, your treatment as applied to me would, I am almost certain, prove entirely successful. As it is, my general health has never been so good as it has been since commencing your treatment. I can do nearly double the work and I feel more vigorous than I was at the age of twenty to twenty-five. If the rules are relaxed I at once feel the effect.' As it is, he 'eats a roaring breakfast.'

Remarks.—There can be no doubt in this case that a little exercise between the last meal and bedtime would anticipate the apparently slight nocturnal hyperpyraemia from which the patient occasionally suffers, and thus obviate the necessity for asthmatic acarbonization. And one would have thought that some regular voluntary physiological exercise in the evening, even in the uninteresting streets of Melbourne, was preferable to irregular involuntary pathological exercise in the early morning taken in a solitary bedroom ; but that is clearly a question for the patient to decide. The case is manifestly one of physiological prepotency.

CASE XXXI.—*Frequently recurring nocturnal asthma of nineteen years' duration. Complete relief by moderate dietetic restriction. Under observation 8 months.*

George P—, aged 41 : height 5 ft. 8½ ins. : inclined to be corpulent.

At the age of 22, he contracted pneumonia. Shortly after con-

valescence, he commenced to suffer from nocturnal asthma which has persisted ever since with but few short intervals of freedom. At the age of 25, during some severe asthmatic paroxysms, he had three attacks of haemoptysis. One of these was extremely severe: he is said to have coughed up a 'bucketful' of blood. Each attack stopped the paroxysm instantaneously (referred to in § 401). He is fond of, and takes, a large quantity of bread at each meal. He also indulges somewhat freely in pastry, puddings, and sweets generally.

He was dieted in the usual way, but not at all strictly.

As a result, he ceased in the course of three or four days to suffer from asthma. He has now remained absolutely free for over six months, although he is by no means over-careful in the matter of diet generally, takes but little exercise, and not infrequently more than a little alcohol. He is, however, careful not to take more than the prescribed allowance of bread and to avoid sugar. Of late, his carbonaceous intake has been sufficient to give rise to an increase of weight, yet his chest remains free. The case must be classed as physiologically prepotent to a marked degree.

CASE XXXII.—*Asthma dating from infancy. Complete relief following treatment by diet and exercise. Under observation 9 months.*

Selina M—, aged 19 years: weight 8 stone 10½ lbs. Asthma began at the age of three weeks. Up to the age of seven she suffered two or three times a week. From seven to fourteen she was free. Between fourteen and fifteen, menstruation commenced and the asthma returned about the same time. Since then she has not been free for more than a week, with the exception of seven months while on a sea voyage.

Asthma always comes on the day before menstruation and is then severe: when the flow is well established, some relief is obtained: the relief obtained is directly proportionate to the amount of the flow, which varies.

She is a resident of Sydney, but came to Brisbane for treatment. For a fortnight after arriving in Brisbane, she remained well.

June 1901.—She was dieted by exclusion of sugar and reduction of starch foods to various extents. She was also ordered regular bicycle exercise.

She remained in Brisbane until August 28. During this time she improved considerably, but did not obtain complete freedom from asthmatic attacks. Her weight had fallen to 8 stone.

August 28.—Returned to Sydney.

Subsequent history.—After returning to Sydney, she continued to follow the rules concerning diet and exercise. Curiously enough, under this treatment, she improved to a much greater extent than while in Brisbane, although Sydney had previously been her most

unfavourable place. From August until the following April, with the exception of one slight attack in October, she remained quite free. Then she relapsed. She had abandoned treatment about three months before the relapse occurred, which relapse was at the beginning of the cold weather.

Remarks.—Asthma is notoriously a disorder of ‘freaks,’ and this case seems peculiarly so. Without treatment by diet and exercise, the patient had always been at her worst in Sydney; yet with such treatment she was far better in Sydney (in the same house) than in Brisbane, in which town she greatly improved on her first arrival before treatment was commenced. It is impossible, therefore, to say how much of the benefit she received was due to the treatment and how much to unknown factors. At any rate, she had eight months’ complete freedom in Sydney, and nothing approaching this had ever happened before. I am inclined to regard the physical exercise as even more important than the diet in her case. The influence of the tendency to hyperpyraemia towards the onset of the menstrual period was well marked.

CASE XXXIII.—*Nocturnal ‘spasmodic’ asthma, capable of being dispersed either by inland residence or by restriction of the carbonaceous intake: practical cure by the latter means. Under observation 3 years.*

Alfred S——, aged 43: height 6 ft.: weight 10 stone $1\frac{1}{2}$ lb.: inspector of one of the large Australian banks: muscular and very active.

For the last two and a half years has suffered from ‘spasmodic’ asthma, but only when he is on the eastern slope of the coastal ranges and on the seaboard. Immediately he crosses to the inland districts he ceases to suffer. For example, he was in Brisbane from April 1, 1901, to May 10: during this time he had asthma every night. After this he was travelling in the western districts and remained free. On August 26 he reached Rockhampton on the coast, and had asthma for two nights. This ceased on his departure overland. On September 3 he arrived at Mackay on the coast: that night asthma recommenced and has persisted up to the present day, September 13. The influence of locality is irrespective of temperature: summer and winter seasons make no difference.

His food habits are Australian. He is very fond of meat, which he takes in considerable quantity at every meal: he rarely takes puddings or sweets, and does not eat much bread: he is almost a teetotaller. He has been under treatment by Dr. Francis of Brisbane, who cauterized the septum nasi on several occasions. The result each time was some temporary relief.

September 13, 1901.—Physical examination showed total absence

of any adventitious sounds, and chest expansion and contraction to be unaffected. The case was evidently 'purely spasmodic.' He was ordered to avoid all food except lean meat, white fish, and green non-starchy vegetables : to make breakfast his chief meal, his midday meal less in quantity, and his evening meal least : also to avoid all alcohol except a little light claret. He was accustomed to rest during the evening ; he was now directed to spend his evenings walking or bicycling.

For the ten previous days he had suffered acute asthmatic paroxysms from 3 A.M. to 6 A.M. : during this time he had to sit up and was accustomed to inhale Himrod's Cure. The immediate result of treatment was as follows :—

On September 14, asthma began at 3 A.M. : ceased 4 A.M.
,, 15, ,, 4 A.M. : ,, 4.45 A.M.
,, 16, ,, 5 A.M. ; ,, 5.30 A.M.

On September 16 he had fallen in weight to just under 10 stone : one ounce of toast was added to breakfast, and half an ounce to the mid-day meal.

On September 17, asthma began at 6 A.M. and lasted for ten minutes only. He used no Himrod on this occasion or thereafter. Slight asthma came back at 6.30 and lasted till 8.30 AM.

On September 18, he had ten minutes' asthma about 6 A.M.

On September 19, no asthma in the morning : in the evening, however, he had some asthmatic dyspnoea (slight and lasting only ten minutes) about 8 P.M. He had eaten rather freely of fat mutton for his evening meal, and was sitting still in a hot theatre, having omitted his prescribed evening exercise. He had fallen in weight to 9 stone 12½ lbs. ; and was allowed rice with his breakfast.

From this day (September 21) till October 3, he had no trace of asthma. On October 3, he had slight asthmatic dyspnoea commencing at 6 A.M. and persisting throughout the day ; but on the previous evening he had *for the first time broken rules* : he had eaten heartily of bread and butter for his evening meal and had taken no exercise thereafter.

On October 11, 12, 13, and 14, he had slight morning attacks commencing at 6 A.M. and ceasing entirely after breakfast. Each attack had been preceded by bread and butter in the evening.

On October 16, at 1 P.M., he ate a hearty lunch of fat meat and considerable bread and butter. At 3.30 P.M. he had 'nasal snuffles' ; this symptom had often occurred during the evening which preceded an asthmatic attack : no asthma followed, however, on this occasion.

After this, his official business took him into the western district. On November 19, he wrote saying he was in perfect health and was eating and drinking anything he fancied. He seems thoroughly to

understand his own case, and intends going on restricted diet immediately he recrosses the coastal range.

September 29, 1903.—Under this date he wrote :—‘ I am happy to be able to say that I have not had an attack in Brisbane for several months : it gradually wore off although I did not stick to your diet as closely as I should have done.’

April 1904.—Although he is now stationed permanently in Brisbane, he has practically ceased to suffer from asthma. Occasionally he] has a tendency thereto, but he restricts his diet temporarily and thus ‘ keeps himself in hand.’

Remarks.—This case has been referred to in the body of the work to illustrate the fact that in many cases an extrinsic atmospheric factor is no less essential to the production of asthma than the humoral factor hyperpyraemia ; and that relief may be attained by striking out either of these factors. In this particular case, circumstances rendered it possible to operate only on the humoral factor, but I do not doubt that relief would have been more prompt, if not more complete, had it been possible, through change of locality, to strike out permanently the atmospheric factor. The fact that strict dieting was necessary to disperse the paroxysms in the asthmatic environment, but that the carbonaceous intake so reduced was just sufficient for continued physiological acarbonization, justifies us in placing the case upon the border line between physiological and pathological prepotency (compare § 521).

CASE XXXIV.—Recurrent asthma : complete relief by diet and exercise. Under observation 16 months.

Emily B——, aged 20 years : weight $9\frac{1}{2}$ stone : sub-manageress in large hotel.

Eleven years ago had her first attack of asthma : this lasted for three months. Since then she has had other four attacks averaging three months in duration, but the present one has lasted for over six months.

During an attack she is never free from cough and some dyspnoea, but the dyspnoea awakes her and is severe at about 2 A.M., when she has to sit up for an hour or two. She has very little expectoration. If asthma is present, it is always markedly affected by the menstrual periods : it is distinctly worse for the two days preceding the establishment of the flow: distinctly better thereafter. She is always worse in summer and in hot thundery weather when the air is laden with moisture. For the last three months, she has not passed more than two nights in succession without having to sit up.

She has been under three physicians without experiencing more than temporary relief. Her nasal mucosa has been cauterized on three occasions without even temporary benefit. Her habitual diet is

ordinary : she seems to have taken a sufficiency of proteid : she is very fond of sweets of all kinds.

Auscultation disclosed sibilant rhonchi, with a few mucous râles over both chests. No permanent expansion. She does not suffer from dyspepsia.

January 29, 1901.—Dieted as in Case X.

On January 30, 31, and on February 1, she woke as usual, and there was no mitigation in the severity or duration of the attack. February 2 to 5 inclusive, woke at usual time, but attacks were shorter and so much less severe that she was able to continue lying down. February 6 to 11, she was not woke up at all by asthma, and was better as regards cough, etc., during daytime. February 11 to 14 inclusive, relapsed and had attacks during night, which, however, were not nearly so bad as before treatment. N.B. These three nights were exceptionally hot, moist, windless, and overcast. Ordered to take potass. iodid. gr. x. at bedtime.

February 15 and February 18.—Woke with asthma at usual time.

February 20.—Free from asthma since 18th. Weight 9 stone 4½ lbs. Toast restricted to a quarter of a round at breakfast only.

March 1.—Has had no night attacks since February 18 : has practically no cough, nor any wheezing. Weight 9 stone 3 lbs. She has taken quite two hours' exercise every day, sometimes three hours. *Feels weak and tired at noon and 5 P.M.* To add to diet half a pint of hot milk at 11.30 A.M. and 4.30 P.M. Nightly dose of iodide to be reduced to gr. v.

March 3.—Slight asthma and cough commencing at 3.30 A.M. With this exception she remained absolutely well in all respects from February 18 to March 21 : she ceased the iodide on March 16. The draught of hot milk morning and afternoon had removed the sensation of weakness previously experienced at these times.

March 21 and 23.—Asthmatic attacks occurred at 3.30 A.M. Both days were very wet and close, and outdoor exercise had to be abandoned ; besides this, menstruation started on the 22nd, and the flow remitted somewhat on the 23rd, becoming fully re-established on the 24th. Weight 9 stone 2 lbs.

April 15.—Two slight asthmatic attacks at usual hour since last note : these occurred on April 6 and 10 respectively. Menstruation commenced on March 31, but ceased next day, reappearing on April 10 during the daytime. Weight 9 stone 1 lb.

April 29.—Only one attack since last note, on April 22 : this was severe but short, lasting only from 2.30 A.M. to 3 A.M. For last three days has been learning to ride bicycle. Weight 9 stone 2 lbs.

July 12.—Weight 9 stone 4 lbs. Had two or three rather severe attacks about May 16 and 23. This was during the Exhibition week : business was very brisk at the hotel, and consequently she had missed

all her regular exercise : in fact she had not been able to leave the house for a week.

October 15.—No attack between May 23 and October 2.

On October 2, 3, and a few days later, she had attacks during the early morning. Menstruation appeared on the 3rd, and the weather was rainy. For nearly a month before these attacks she had been almost on an ordinary diet, including sweets, etc. She has been well since. Weight 9 stone 6 lbs. : this is about her usual weight.

April 26, 1902.—Absolutely no asthma since last note, a period of nearly seven months. Has returned to her original diet, eating almost anything she fancies. She continues, however, to take exercise regularly. The tendency to asthma seems to have quite disappeared.

Remarks.—The precipitating influence on asthma of the pre-menstrual tendency to hyperpyraemia and rise of blood-pressure was well marked ; also the influence of carbohydrates, heat, moisture in the atmosphere, and deficiency of physical exercise. It is noteworthy that intranasal cauterizations failed completely : possibly there would have been a different result had this treatment been continued longer. The case should probably be classed as physiologically prepotent, since the dietetic restrictions were not rigidly adhered to, and the loss of weight was but slight.

CASE XXXV.—Violent paroxysmal asthma. Failure of dietetic treatment. Under observation 3 months.

Marie D. C——, aged 24 ; weight 6 stone 12 lbs.

Has suffered from paroxysms of asthma for the last three years. Her first attack commenced without any warning at 8 A.M., and lasted for several days. Her second occurred four months later and began about 2 A.M. : this lasted three weeks. Since then she has had one interval of seven weeks : excepting this, two or three weeks has been her longest interval. During the intervals, she is quite well, having no cough or sign of bronchitis. Menstruation regular and apparently without influence on the asthmatic attacks. For the last three months, oedema of ankles, worse towards night.

August 9, 1901.—Admitted into Diamantina Hospital. She is rather anaemic and thin, shy, and of an extremely nervous disposition. Pulmonary sounds quite normal. Heart shows some dilation of right side. Pulse varying in frequency between 88 and 116, small and *very low tension*.

Diet.—Twelve ounces lean meat : three ounces of starch food : butter : green non-starchy vegetables *ad lib.* : milk two pints. Ordered gentle exercise three times daily, especially in evening.

August 11, 12, and 13.—More or less asthmatic breathing, but no violent paroxysm.

August 18.—Moderate asthmatic paroxysm at 6 A.M., relieved by Himrod's cure.

August 19.—Paroxysm at 4 A.M., relieved by Himrod.

August 22.—More or less asthmatic dyspnoea through afternoon and night.

August 23.—Violent asthma through morning, afternoon, and night, hardly relieved by Himrod and necessitating morphia hypodermically.

August 24.—Better, but still asthmatic.

August 27.—Free for last three days. She says that during the last six months the paroxysms have lasted on and off for a fortnight and have been extremely severe: that the attack from which she has just recovered is the mildest and shortest since she became asthmatic.

Subsequent history.—She continued to have violent asthmatic paroxysms at intervals during the rest of her stay in hospital: the above record is fairly representative of the remainder of her stay. During several of her bad attacks, the violence of the dyspnoea would abate somewhat for a time and, during this interval of comparative respiratory relief, she would suffer from suddenly commencing vertical headache, so violent as to cause her to scream. These headaches were manifestly congestive, for they were associated with deep flushing of the neck, face, and conjunctivae. Relief could only be afforded by compression of the carotids. At the end of about fifteen or twenty minutes, the dyspnoea would return in its full force, and synchronously the headache and flushing of the face and neck would cease. An identical substitution of cranial for bronchial symptoms could be deliberately induced at any time during a paroxysm by amyl nitrite inhalation.

According to the patient's account, the asthmatic paroxysms were shorter and less frequent since she came under dietetic treatment. I could not, however, assure myself that they had improved in any way since her admission; and she was losing weight, if not strength. The treatment was therefore abandoned, and for the rest of her stay in hospital she was treated symptomatically on ordinary lines.

November 11, 1901.—Discharged unimproved.

Remarks.—This case stands alone in my experience in that it is the only case of asthma in which I could not assure myself that some slight degree of improvement accrued from restriction of the carbonaceous intake. It is true that the paroxysms were shorter and separated by wider intervals than previously; but this may fairly be said to have been counterbalanced by the loss of weight which she could ill afford. The patient was nervous, impulsive, and difficult to

manage; and it is quite likely that she did not follow with absolute strictness the dietetic rules laid down. But that is true of the majority of hospital patients, especially of women; and her observance was, at any rate, sufficiently strict to cause loss of weight. This case was unusual in several respects, especially in the absence of any menstrual influence. *There was manifestly pathological prepotency to a very high degree* (§ 511), but the secondary factors responsible for this condition were not apparent. Possibly, cauterization of the nasal septum would have been of advantage. The alternation between dyspnoea and headache has been referred to in the body of the work (§ 502).

CASE XXXVI.—*Recurrent croup: ulcerated sore throat: suppurative tonsillitis: headaches: hay-fever: rheumatoid arthritis: angina pectoris: asthma: bronchitis. Relief of last two by diet and exercise. Under observation 3 months.*

Mrs. A—, aged 39: weight 11 stone $5\frac{1}{2}$ lbs.

Up to the age of 14, she suffered from very frequent attacks of croup which seemed to be induced by every slight change of weather.

At the age of 14, the tendency to croup ceased finally. For the following year, she had frequent sore throat with ulceration of the tonsils. Three of these sore throats resulted in quinsy necessitating incision to evacuate the pus.

Then between 15 and 17, she became a martyr to frequently recurring severe headaches: sometimes these would keep her in bed for many days together—for some weeks in one instance.

For the following nine years she seems to have enjoyed good health.

At the age of 36, she began to suffer from hay-fever: for the following year, she suffered severely every morning without exception.

Three months after the commencement of the hay-fever, she was suddenly attacked by 'rheumatic gout' in both knees, both ankles, and both elbows. This laid her up for two months, after which she recovered sufficiently to be sent to the hot springs in New Zealand. On her arrival there, she was quite unable to walk, but shortly derived considerable benefit from the bathing as far as concerned the arthritic affection. During her stay at the springs, she continued to suffer from hay-fever. She also at that time experienced five or six attacks of typical angina pectoris, each attack being associated with extreme 'grey pallor' of the face.

On recovering the use of her limbs sufficiently to move about slowly with the aid of a stick, she returned to Sydney. Here she sought the advice of a rhinologist; but this gentleman refused to treat her nose locally, fearing the induction of asthma by such

a procedure. As a matter of fact she was at that time commencing to suffer from slight asthmatic manifestations.

Accordingly, she visited Melbourne, and there another rhinologist 'operated three times on her nose with a knife': this resulted in a little relief lasting for a few weeks.

After this, she returned to Sydney, where she experienced her first overt asthmatic paroxysm between three and four o'clock one morning. *Thereupon or immediately thereafter, she ceased to suffer altogether from her joint troubles, nor have these ever returned.* She also enjoyed an interval of three months during which she remained free from asthma.

In June 1901 (aged 38) she caught a severe cold and was laid up in bed for three months with a 'mixture of bronchitis and asthma.' In August following, she returned to Melbourne, where she suffered almost constantly from asthma.

In June 1902 (aged 39) she went a sea trip up the Queensland coast as far as Cairns. This did her much good: she lost both her cough and asthma, so long as she remained at sea.

On July 10, 1902, she consulted me. She was then suffering from asthma with vascular obstruction of the nares and profuse nasal secretion. Auscultation disclosed general sibilant and sonorous rhonchi. The patellae creaked and grated markedly when the knee-joints were worked, but there was a complete absence of subjective arthritic symptoms. She was well nourished, indeed rather stout: she habitually took very little exercise; and she had always had an excellent appetite and an exceptionally strong digestion.

As she was unable to remain more than about ten days in Brisbane, it was necessary to make a quick impression upon her symptoms. Accordingly, she was dieted somewhat strictly, starch foods being cut down to one and a half ounce per diem. She was also ordered to take walking exercise between meals and especially in the evening.

On July 12, menstruation began. There was no improvement, but the usual menstrual exacerbation of asthma was absent. On July 14, a little improvement in both nasal and bronchial symptoms: weight 11 stone $3\frac{1}{4}$ lbs. On July 18, very marked improvement: obstruction of the nose and all discharge ceased this morning: also all cough and wheezing. *July 23.* Remained free from all symptoms until this morning, when there was a slight recrudescence which passed off after breakfast: weight 11 stone 1 lb.

Two months later, I heard from this patient. She had had no actual attack of asthma, though she had had indications: her nose troubles her slightly on occasions; but on the whole she is greatly improved and can manage her own case now.

Remarks.—This case presents a rather remarkable series of

alternating affections, which together extended over the greater part of her life, and which probably owned in each instance a hyperpyraemic factor. In her case, it is unlikely that the prescribed treatment will be followed for any length of time, since she has epicurean tastes and heartily dislikes exercise. Should this forecast prove correct, it will be interesting to speculate as to the further evolution of the hyperpyraemia. The best that can happen in these circumstances is probably the gradual development of obesity.

CASE XXXVII.—*Recurrent coryza : recurrent acute bronchitis : recurrent nocturnal asthma with nasal congestion. Rapid relief by diet and exercise.*

Mrs. Q—, aged 46: weight 9 stone 10 lbs.: menses regular. Has suffered from recurrent 'respiratory' affections for about twenty years. At first, she had severe recurrent coryza or hay-fever: later, recurrent acute bronchitis with considerable rise of temperature: later still, typical asthma, the paroxysms usually occurring between 2 and 3 A.M. Through all the phases of her affection she has continued to suffer from her nose, which now becomes 'stuffed up and inflamed' antecedent to her asthmatic paroxysms.

For the last two or three years, she has been better in all respects, but she has recently returned from Sydney, in which city she had a severe recrudescence. She is at present suffering from mild asthmatic paroxysms in the early morning, together with a constant sensation of obstruction in the nose.

Examination disclosed engorgement of the turbinateds; also sibilus at both bases towards end of expiration.

November 22, 1901.—She was ordered a three-mile walk every evening and put upon the following diet:—

Breakfast.—Anything except articles containing sugar.

Lunch.—Clear soup: lean meat, white fish, or both: green vegetables, except those containing starch: three-quarter ounce bread.

Dinner.—Same as lunch.

November 26.—Much better in all respects, including nasal symptoms.

Note made on December 17.—Since last note has been practically well and has merely called to say so: the only remains of her trouble are a very slight 'stuffiness' in the nose and a very slight 'huskiness' of the voice on first awaking: this ceases in a few minutes. She is not following the rules very strictly now because she feels 'quite as well as she wants to.'

Remarks.—It is not usual for all symptoms to disappear practically in four days, but the case was a very mild one when it came under treatment, and was moreover improving at the time.

CASE XXXVIII.—*Asthma, paroxysmal sneezing, and early obesity, succeeding recurrent croup, bronchitis, and catarrhs. Rapid relief from the first affection by diet only. Under observation 1 year.*

Miss D—, aged 22: weight 12 stone $5\frac{1}{2}$ lbs.

As a child had many attacks of croup and also bronchitis. Up to the age of about 18, she suffered almost constantly from colds in the nose, throat, and chest. For the last three years, she has suffered on and off from paroxysms of asthma, coming on during the night or early morning: during this time, she has ceased to suffer from colds, with the exception of last winter, when she had two severe and prolonged colds: while these colds were on, and for a week or so afterwards, she remained free from asthma. At the age of 15, menstruation began: it was normal in all respects, being regular and moderately profuse. At 16, she began to grow very fat and has continued to increase in weight since. Concurrently, her menstrual periods have become less frequent and more scanty: at the present time the interval is six weeks, the flow lasts but two days and consists of a mere stain. Her left nostril is much obstructed, and she suffers at times from violent paroxysms of sneezing.

Upon a mainly lean meat diet, sugar being interdicted and starch reduced to three ounces per diem, she has rapidly improved in all respects. Her weight falls rapidly, the nostril becomes comparatively free, and the asthma ceases. She is, however, a bad patient, being intensely fond of sweets and lacking in perseverance: consequently, relapse is frequent.

Remarks.—This case presents a long procession of alternating manifestations of hyperpyrexia, some of them acarbonizing processes and all of them falling upon the respiratory tract. It illustrates also the tendency to alternation between the two physiological decarbonizing processes, menstruation and fat-formation, as well as the facility with which hyperpyrexia may be dispersed when the latter capacity is well developed. The case must be regarded as physiologically prepotent.

CASE XXXIX.—*Paroxysmal asthma: haemorrhoids: recurrent diarrhoea. Relief by diet and exercise. Under observation 1 year.*

John F—, aged 46: a tall well-built labouring man. Caught a severe cold during the 1893 floods in Brisbane and was laid up with bronchitis for three months. Before he was completely convalescent, he began to suffer from recurrent asthma, always commencing in the middle of the night and lasting two or three days. At first, he had intervals of freedom lasting six or eight weeks. Of late years, these intervals have been shorter and the duration of the asthmatic attacks longer: the latter have lasted as long as twelve

days. He has been treated on several occasions by cauterization of the septum nasi, but only received slight temporary relief therefrom.

For the last two or three years, he has suffered from haemorrhoids: these bleed furiously at times. If his piles are bleeding, he suffers from no asthma: indeed, if they commence to bleed during the continuance of an asthmatic paroxysm, the latter invariably ceases at once.

On several occasions lately, the haemorrhoidal haemorrhage has suddenly ceased, and immediately thereafter he has had profuse watery diarrhoea. The motions are passed without the slightest pain, and they have amounted to a dozen in the twenty-four hours. These attacks of diarrhoea are preceded by, and associated with, distension of the epigastrium and a feeling of fulness over the liver: the diarrhoea seems to afford relief from these symptoms. During the attacks, he has never had any asthmatic manifestation or any anal haemorrhage: in fact, the asthma, haemorrhage, and diarrhoea distinctly alternate.

March 13, 1902.—Admitted to Diamantina Hospital. He turned out to have an enormous appetite, comparable only to that of some diabetics, and to have a very powerful digestion. He was naturally a great meat eater, but of late, through bad times, had lived mainly on bread.

He was ordered a large lean meat diet, with green non-starchy vegetables, one ounce only of bread, and a pint of milk. The bread to be all taken at breakfast: his evening meal to consist of lean meat only, and this to be restricted in amount to four ounces.

On this, he rapidly improved: and from April 4 to April 20, remained free from asthma, haemorrhage, and diarrhoea: this triple freedom had not occurred for more than twelve months previously. He then left the hospital, but I continued to see him at intervals for a year. He had several relapses, owing to his inability to obtain the diet ordered. He informed me, however, that he was now able to manage himself and that he could keep himself practically free from all three affections by living mainly upon meat and working hard.

Remarks.—The alternations of the three pathological acarbonizing processes, namely, asthma, haemorrhoidal haemorrhage, and diarrhoea, were exceptionally well marked. The case may be regarded as physiologically prepotent. His enormous appetite must be regarded as his most pathological capacity: it was manifestly out of proportion to his physiological acarbonizing capacities.

CASE XL.—Recurrent asthma with chronic bronchial catarrh. Temporary relief from diet. Treatment abandoned on account of muscular weakness and loss of weight.

R. B—, aged 55: weight 8 stone $3\frac{1}{2}$ lbs.

History.—He was a working miner until 1893: then his weight averaged 10 stone. Since then, he has been a politician: after giving up manual labour, he lost considerably in weight. In 1898, he had an attack of pneumonia: eight or nine months later, he gradually commenced to have asthma, the paroxysms of which were at first and for some time purely nocturnal, being limited to the hours between 3 and 5 A.M. Of late years, he has had attacks at all times, and for considerable periods has been continuously asthmatic. He has, however, had occasional periods of freedom. One of these was when travelling through his constituency in North Queensland, which he accomplished for the most part in the saddle: his asthma recommenced when he reached those districts in which he was able to travel by train. Another interval of freedom, or comparative freedom, was during a particularly heavy Parliamentary session comprising many all-night sittings—he was a leading member of the Opposition, who had adopted tactics of obstruction: his asthma returned, if I remember aright, as one result of the application of the *clôture*; and it increased in severity during the recess. His septum nasi was cauterized on several occasions by Dr. Francis, but with only temporary relief.

His habitual diet is the ordinary rather plain mixed diet. He is never dyspeptic. Bowels always regular, rather loose than costive.

Present condition.—He is very thin and more or less continuously asthmatic, but worse during the night and early morning. His chest presents the typical asthmatic configuration, there being apparently some permanent distension: expiration much prolonged: a few sibili towards the end of expiration. Apex of the heart displaced downwards and to the left, about one inch: systolic sound reduplicated (N.B. This is extremely common in Queensland miners): pulse regular, 80, tension about normal, a little decreased if anything.

Treatment.—He was ordered gentle but regular exercise, especially in the evening; and rather strictly dieted, his starch foods being cut down to one and a half ounce per diem.

He obtained no relief for five days after the commencement of treatment. Then he began to improve. For several nights he remained quite free from asthma, and he was able to walk quickly on the flat without getting short of breath. He, however, lost weight which he could ill afford, was very hungry between meals, and suffered from distinct muscular weakness, especially of the muscles of the anterior aspect of the thigh. Consequently, his carbonaceous intake was increased, but the increase brought on the asthmatic paroxysms as bad as ever; and treatment was abandoned.

Remarks.—There was evidently a marked degree of pathological

prepotency in this case: as far as could be ascertained, the carbonaceous intake consistent with freedom from asthma was insufficient for continued due nutrition—for adequate physiological acarbonization. In some such cases, good results can be obtained by raising the carbonaceous intake and depending for physiological acarbonization upon a maximum of physical exercise. This patient, however, was a very busy man and unable to afford the necessary time.

CASE XLI.—*Alternating angina pectoris, asthma, sick-headaches, sciatica, tonsillitis, pyrexial attacks, leading up to incipient rheumatoid arthritis. Under observation 18 years.*

M. J—, aged 42: weight 13 stone.

He was engaged in business in North Queensland (lat. 18°). Enjoyed good health up to age of 28, i.e. the year 1890. At that time, he began to suffer from irregularly recurring attacks of 'spasmodic' asthma which left no bronchial catarrh behind them. These continued to recur up to the year 1896. During the last twelve months of this period, the asthmatic seizures were less frequent and severe, but he also suffered from attacks of typical angina pectoris: these latter steadily became more frequent and severe. From 1895 to 1898, he suffered from angina pectoris.

In 1899, the angina ceased, and he suffered from extremely severe recurrent headaches, associated with complete anorexia but no vomiting. He was also greatly troubled with intense constipation. Purging gave much relief from headache.

In 1890, his headaches ceased and he began to suffer from severe sciatica. Later in the year, he had recurrent attacks of fever (regarded at the time as malarial, but unaffected by quinine), and one severe attack of tonsillitis. He was now greatly emaciated (under 10 stone) and went to New Zealand. He remained three months in that country, and while there rapidly recovered his health, putting on nearly 3 stone in weight.

Thereafter, he returned to his office in North Queensland, where he rapidly went downhill again, the anginal seizures returning with increased violence and being associated with steady loss of weight. External heat seemed the dominant pathological influence in his case: under it, dietetic restrictions failed (if indeed they were ever consistently practised, which is doubtful), and physical exercise to any useful extent was impossible. Accordingly, he sold his business and settled in Sydney.

In Sydney, he enjoyed much better health again: he rapidly put on the weight he had lost, and even became stouter than at any previous period of his life. In the Sydney winter, he remained

practically free from angina, but during the summer he continued to suffer from occasional attacks

In February 1904, I advised him to consult Dr. Pockley of Sydney in order to have his eyes examined. That gentleman reported, 'an Esophoria of 13°, also under homatropine

In R.E.	$\frac{0.5\text{DH}}{0.5\text{DH}}$	axis/ 45°
,, L.E.	$\frac{0.5\text{DH}}{0.5\text{DH}}$	axis/ 45°

Such a condition is a frequent cause of paroxysmal headache, and it is quite possible that it might be a cause of paroxysmal neurosis affecting the heart also. I have prescribed glasses.'

He was ordered to wear these glasses constantly : he did so fairly constantly ; but no marked salutary influence upon his anginal seizures was apparent three months later.

The patient is an extremely unsatisfactory one for dietetic, or any other, treatment which demands continuity of self-restraint : he is impulsive and impatient, and has a hearty appetite and a powerful digestion. He is, moreover, very sceptical as to the value of medical men generally ; and the fact that he is an old personal friend of my own probably increases this scepticism in my case. Nevertheless, I think I have recently succeeded in making some little impression upon him. The two following incidents have at least persuaded him that food is connected with angina :—(1) He had been well for some time and consumed a considerable quantity of Turkish Delight ; some hours later he had an extremely violent anginal seizure. (2) At midday dinner on Sunday, he consumed two helpings of a particularly good plum-pudding. He had been warned whenever such lapses occurred, to follow them up by no small amount of physical exercise. On this occasion, however, his correspondence was in arrears, and he spent the afternoon at his writing-desk : at 4 p.m. he had one of his worst anginal paroxysms.

Again, I had frequently warned him that, although it was impossible to foresee the exact lines upon which his affection would evolve, yet he ran no inconsiderable risk of contracting rheumatoid arthritis, articular gout, or some allied joint affection. At the beginning of March 1904, he commenced to have slight pain and disability of one knee-joint. He concluded he must have sprained it unknowingly. But a week or so later, the other knee became affected in an identical manner. The pain and stiffness were most marked on rising in the morning, or after sitting still for some time : they passed off rather rapidly after walking. These are, in my experience, always the first symptoms of chronic rheumatoid disorder attacking the knee-joints. Further, on placing the hand firmly on the patella

and making him extend *very slowly* the leg upon the thigh, the creaking sensation elicited was more marked than it should have been under purely physiological conditions of the joint surfaces. Under a considerable restriction of food, especially of the purely carbonaceous food-stuffs, the subjective symptoms became much less in a few days.

Remarks.—I regard this case as physiologically prepotent, that is, as due to a carbonaceous margin in the blood over and above what is essential for physiological acarbonization. And I honestly believe that life in a cool, or better, a cold, climate, combined with regular physical exercise and a regular food-supply, not in excess of his bare physiological requirements, would, even now, result in complete convalescence. But I doubt if the patient would consider 'the game worth the candle.'

CASE XLII.—*Recurrent angina pectoris, mainly pre-menstrual and nocturnal. Relief by diet and moderate exercise: complete relief by severe and prolonged exercise without dietetic restriction.*

Miss V—, aged 25.

She has suffered on and off from early childhood from lymphatic tuberculosis; this has necessitated numerous small operations.

In June 1898, she underwent one of these small operations in a London private hospital. During convalescence, she was kept at complete rest for three or four weeks and fed upon a mainly carbohydrate slop diet. Towards the end of this period, she began to suffer from severe attacks of pain in the praecordia, lasting ten or fifteen minutes and associated with extreme pallor of the skin and visible mucous membranes. The attacks came on after slight exertion and during the night after a few hours' sleep: they were especially severe and frequent on the day preceding, and on the first day of, menstruation. They continued to recur with gradually diminishing frequency for the following five months.

In February 1902, she underwent another small operation in similar circumstances. Her convalescence was greatly interfered with by the death of a near relative shortly after the wound healed. She then began to suffer from the same severe paroxysms of cardiac pain, coming on under the same conditions. In addition, she had attacks of syncope: these for the most part alternated with the painful attacks, though, on some occasions, the latter terminated in the former. In three or four months' time, she ceased to suffer from either form of attack.

Both before 1898 and between 1898 and 1902, she suffered from very frequent 'influenza colds,' during which her nose and eyes were especially affected. She has also suffered from four attacks of

bronchitis, associated with fever and necessitating confinement to bed for some weeks.

She has always been of an active and athletic tendency, and has found that when taking regular severe outdoor exercise, such as swimming, rowing, walking, and riding, she remains free from catarrh, from cardiac pain, syncopes, and disorders of all kinds: in short, she enjoys perfect and robust health.

On January 2, 1903, she left London by one of the large mail steamers for Sydney. On nearing Port Said, the attacks of cardiac pain recurred. These became more frequent and severe as the tropics were entered, and the fainting attacks recurred with greater intensity than before. Several medical men who happened to be on board consulted together on her case: as a result, all exercise, even going up the companion unassisted, was interdicted; and amyl nitrite, occasionally hypodermic injections of morphia, were prescribed.

In March 1903 the patient arrived in Brisbane and came under my treatment. I saw her in several attacks of cardiac pain. There was marked cutaneous vaso-constriction, as evidenced by extreme pallor of the face and lips and palpable tightening of the radial artery. Any form of heat, hot baths, hot dry or moist flannels to the chest, hot drinks, whether water, tea, or coffee, gave instant relief, bringing the colour back to the face and relaxing the radial artery. Inhalation of amyl nitrite had a similar influence: this drug also on several occasions instantly terminated an attack of syncope which was unattended by any pain. Its use, however, had to be given up in the menstrual attacks (which were the most severe), since it invariably stopped the flow and terminated the period, with the further result that a series of attacks was induced. The patient then informed me that this had happened on several occasions, in fact, whenever the drug had been used during menstruation.

The treatment consisted of regular physical exercise thrice daily, together with the exclusion of sugar and the restriction of starch-foods to about four ounces per diem.

The result was satisfactory on the whole, although her observance of rules was not over-conscious. The accurate way in which the influence of physical exercise on the anginal seizures followed the rise and fall of blood-pressure was clearly marked. On several occasions, without my sanction, she started to walk when an attack of angina was impending. On each occasion, the cardiac pain increased for the first three-quarters of a mile, after which it rather suddenly ceased and did not recur during the continuance of the exercise, no matter how severe this was. Skipping, which she practised on wet days and in the evening, had an identical effect if commenced when a paroxysm was impending.

In July 1903 the patient paid a visit to a Queensland cattle station, where she remained until the middle of September. During this period, she was almost continually in the saddle, riding long distances, on one occasion upwards of fifty miles during the forenoon and afternoon. Also she abandoned all dietetic restrictions according to my advice. The result was altogether satisfactory. During the whole of her visit and for several weeks after her return to Brisbane, she remained absolutely free from attacks of all kinds: indeed she enjoyed for the time being perfect physical health. Four weeks after her return to Brisbane, however, there was a slight recurrence of angina (pre-menstrual); and as the weather was then becoming hot, she was advised to go back to England.

Remarks.—This case is typical of many which occur in young and middle-aged, otherwise healthy, persons. The patient was an habitually active girl, devoted to all kinds of outdoor amusements, and fully conscious that hard physical exercise was a condition essential to her perfect well-being. On all three occasions, the commencement of the series of anginal seizures was preceded by a period of enforced inactivity. In addition to the loss of habitual exercise, there was added, on the first two occasions (after operation in private hospitals) an unduly carbonaceous diet: on the last occasion, the severe heat of the tropics.

CASE XLIII.—*Angina pectoris, preceded by recurrent tonsillitis, refractive headaches, rheumatic fever, and migraine; and succeeded by muscular rheumatism, asthma, and osteo-arthritis. Complete relief from angina through restriction of the carbonaceous intake and exercise.*

Dr. C—— H——, aged 38: height 6 feet: weight 13 stone.

Between the ages of twelve and sixteen, he had frequent relapsing tonsillitis. From sixteen to eighteen and again from twenty-two to twenty-three, he suffered from refractive headaches, completely relieved by correction of astigmatism; his eyesight was always better and his headaches less when he was taking much walking exercise. At the age of twenty-six, he had a slight attack of rheumatic fever, and at the age of twenty-seven, a second shorter attack. Between the ages of twenty-eight and twenty-nine, he used to suffer from slight migraine attacks. At the age of thirty-two, he suffered from his first attack of angina pectoris; and this continued to recur up to the age of thirty-six, when he came under my care. At the age of thirty-four, however, he had an interval of freedom, due, he is now convinced, to the fact that at that period his occupation entailed considerable physical exercise. Later, he ceased to take much exercise and his angina returned.

Each anginal seizure was associated with palpable tightening of

the radial. He had consulted several leading physicians. No organic lesion was found. He was given general instructions as to his mode of life: these differed a little in detail with the physician consulted; but all were agreed that he must be especially careful to avoid anything in the shape of severe physical exercise. On the plan prescribed, he continued to suffer at irregular times, moderating attacks by the use of amyl nitrite.

At the age of thirty-six, his attacks were commencing to be more frequent and severe. He was then engaged in a very large practice and was taking but little physical exercise: there was also a considerable prominence of carbohydrates in his diet.

He was advised to cut down his starchy and saccharine articles of diet and to take more lean meat and green vegetables: also to do a considerable proportion of his visiting on a bicycle. The effect was very rapid: he ceased forthwith (i.e. within a few days) to suffer from angina. Later, relaxation of dietetic rules and diminishing exercise brought about a slight relapse, which was again dispersed as before.

At the age of thirty-seven, he had again relaxed in the matter of treatment; but at this time he had apparently lost the tendency to angina: instead, he began to suffer from slight nocturnal asthma. This was dispersed in the course of a week or two by the same treatment as was found effectual in the case of the angina.

About the time he commenced to suffer from asthma, he had slight osteo-arthritis on one terminal phalangeal joint: since then, he has had some osteo-arthritis of one shoulder-joint, and this is now present. He has also suffered from muscular rheumatism and occasional attacks of slight hay-fever.

Remarks.—This case is very similar to Case XLI, but the various hyperpyraemic manifestations were differently arranged and they were all much less severe. I see no reason why the rheumatoïd manifestations should not be practically recovered from; but a much more prolonged and careful line of treatment will undoubtedly be required to attain this end. The case has been referred to in the body of the work (§ 410).

CASE XLIV.—*Angina pectoris, alternating with recurrent secondary dyspepsia and anorexia: uro-lithiasis. Complete relief from all by diet and exercise.*

Joseph S—, aged 46: total abstainer.

Until ten years ago, he lived in the bush and was taking constant exercise in the open air: then he was always in perfect health. About ten years ago, he began to suffer from indigestion in distinct attacks. These were associated with nearly complete loss of appetite: they would come on without apparent cause and would

last from two to three days: they recurred at irregular intervals, sometimes as often as once a fortnight, at other times only once in three or four months. Five years ago, he took to riding a bicycle: immediately, his health improved in all ways: his indigestion ceased and he remained absolutely free from attacks for twelve months, even in spite of indiscriminate eating. Eighteen months ago, he began to suffer from sudden attacks of severe pain in the region of the heart: on two or three occasions, the cardiac pain extended down the left arm. These new symptoms commenced after having omitted bicycling exercise for a fortnight: they have recurred five or six times since. The attacks of indigestion and the attacks of cardiac pain never concurred.

Two months ago, he went to Sydney and there had an unusually severe paroxysm of cardiac pain. The physician who treated him cut off all starch foods and sweets except honey. Since then, he has had no cardiac symptoms, but he has had two attacks of indigestion. The first dyspeptic attack was identical with his old attacks, being associated with loss of appetite: in the second, he had, in addition to loss of appetite, very considerable pain in the hypogastric region.

During his attacks of indigestion, he has always passed much gravel in his urine: on one of these occasions, Dr. Hawkes (who sent this patient to me for consultation) found a distinct albuminous cloud. He also found distinct enlargement of the liver which passed away in the course of a few days. There were also present congestion of the fauces, redness and swelling of the larynx, and enlargement of the lingual tonsil.

This patient was dieted in the usual way by exclusion of sugar and restriction of starch foods: the necessity for constant exercise was strongly impressed upon him.

Several months later, he wrote saying that he had carefully followed the treatment and had remained quite free from both kinds of attacks.

Remarks.—Cases presenting similar, and indeed identical, combinations and alternations of symptoms, are, in my experience, very commonly met with in general practice. But it is customary to explain them differently. The humoral, vaso-motor, and hepatic factors, are, for the most part, omitted from consideration. The dyspepsia is regarded as primary, that is, as due to functional derangement of the stomach itself or to some recently antecedent error of diet; and the cardiac symptoms are regarded as dyspeptic, perhaps as due to flatulent distension of the stomach, or as reflex manifestations from irritation of the gastric terminations of the vagus. But all such views fail to account for the following:—(1) The recurrent hepatic enlargement: (2) the fact that the dyspeptic

attacks are often regularly recurrent: (3) the fact that a special recently antecedent error of diet is rarely to be identified: (4) the salutary influence of physical exercise: (5) the fact that the dyspeptic and cardiac symptoms tend to alternate rather than concur; and (6) the uro-lithiasis. On the other hand, recurrent hyperpyraemia, associated as it often is with recurrent glycogenic distension of the liver, recurrent disordered vaso-motor action, and recurrent uricaemia, will readily explain the whole series of phenomena.

CASE XLV.—*Paroxysmal bradycardia, succeeding periodic headaches and slight asthmatic and anginal seizures: associated with bronchial and other catarrhs, eczema, and rosacea; and completely relieved through pathological acarbonization, mainly incidental.*

John R—, aged 44: weight 14 stone 9½ lbs.

Originally he had been a working man; then he had remained in perfect health. At the age of 30, having saved a little money, he occupied for a few years the position of landlord of a small hotel. It was then that his health began to fail, as he was much confined indoors and continued to eat and drink heartily. At first, a simple increase of weight resulted: later, he began to suffer from periodic headaches, associated with severe digestive symptoms: later still, the digestive symptoms largely subsided, and he commenced to have 'wheezing attacks' in the early morning, and cardiac pain on sudden exertion. About this time, his face showed distinct signs of early rosacea and he developed rather severe eczema of both legs. The nocturnal wheezing and cardiac pain persisted on and off for about a year and a half. At about the end of that period, he began to suffer from vertiginous attacks; and these gradually became more severe, finally amounting to actual syncope.

It was at this time that he came under my observation. In addition to the syncopal attacks, he was then suffering from the following:—Post-nasal, pharyngeal, and bronchial catarrh, rosacea (without hypertrophy) of the nose and adjoining area of the cheeks, eczema of the legs, some varicosity of the veins of the legs, and a small ulcer on the left leg.

On examination, his pulse was 60, regular, high tension; heart somewhat enlarged, apex beat being depressed about $\frac{1}{3}$ in., impulse heaving and second sound accentuated; no albuminuria, polyuria, or glycosuria.

The syncopal attacks were liable to be precipitated by attacks of temper (to which he was rather subject), by any sudden exertion, and by exposure to cold: one of his worst was brought on by a shower-bath. I never saw this patient in one of these attacks, but he informed me that his pulse became very slow before he fainted: this he had observed himself before he came to me.

He improved somewhat under nitro-glycerine, but, being of a careless disposition, he shortly abandoned the drug. Shortly thereafter, he had a severe attack, apparently of an epileptic nature : at any rate, he was found lying unconscious with a lacerated scalp wound. This became septic, and he suffered for some weeks from suppurative cellulitis and considerable pyrexia.

During this time all his previous symptoms disappeared, some immediately, some gradually. From the date of the accident, he had no more vertiginous, syncopal, or convulsive attacks, and his pulse-rate rose quite normally with the pyrexia. The eczema of the legs and the eczematous or varicose ulcer rapidly healed : the rosacea paled and practically disappeared ; and so also disappeared all traces of respiratory catarrh.

Twelve months later, he had a slight return of the eczema, rosacea, and bronchial catarrh ; but his pulse-rate remained about 70, and he had quite ceased to suffer from all symptoms dependent on paroxysmal bradycardia.

Remarks.—This case has been introduced mainly to illustrate the graduation of pathological acarbonization depending on hyperpyrexia into incidental pathological acarbonization ; for it cannot be included under either head alone. The fall and the resulting head injury were obviously dependent on the hyperpyrexia ; yet had no scalp wound resulted, or had the scalp wound remained aseptic, it is improbable that any relief from hyperpyrexia would have accrued. The case may be compared with West's cases referred to in § 328.

CASE XLVI (communicated by Dr. Hawkes).—*Recurrent gastralgia, anorexia, and nausea : anaemia : debility. Rapid and complete relief by exclusive diet of lean meat and milk.*

Miss B—, aged 30.

This patient was sent from Melbourne to Dr. Hawkes under the idea that change of climate and possibly further operative treatment might effect a cure. She had undergone a long course of Weir-Mitchell treatment and had had a loose kidney successfully stitched into position, without any relief from her symptoms. On arrival, she was fat, flabby, very anaemic and extremely weak, hardly able to walk indeed : her special affection was recurrent gastralgia, coming on once a week, with intense pain, anorexia, and nausea.

Dr. Hawkes sent her up country to a comfortable station, with instructions to take nothing whatever in the way of food, except lean meat and milk. (This seemed to be the only kind of dietetic treatment which had not been tried in her case.) The quantities of meat and milk were left to the patient.

During the first fortnight, she remained at rest on a couch and

kept strictly to the diet : at the end of the fortnight, she was taking meat three times daily, together with eight pints of milk, taken in small quantities at short intervals.

Then she began to take a little bread and butter, and to exercise gently, at first driving, later riding.

The result was immediate cessation of the gastralgic attacks, and progressive increase of strength. Her colour returned : she shortly became ruddy, and enjoyed better health than ever before in her life.

Remarks by the author of this work.—This case well illustrates the fact (referred to in § 790), that very often the Weir-Mitchell treatment fails to relieve hyperpyraemic affections through insufficient stress being laid on the importance of the initial period of under-feeding, or rather of restriction of the carbonaceous intake ; also the fact that hyperpyraemic affections in those who are well endowed with the capacity to form fat, are readily amenable to acarbonizing treatment.

CASE XLVII.—*Recurrent gastralgia graduating into continuous gastralgia with neurasthenia. Permanent recovery under Weir-Mitchell treatment plus special diet. Under observation, personal and by correspondence, 3 years.*

Miss McL—, aged 23.

May 20, 1900.—She gives the following history. She is a native of Canada. Six years ago (1894), when seventeen years old, she had an attack of *extremely violent* pain in the epigastrium. The pain lasted six hours and was then succeeded by violent vomiting of a large quantity of bilious fluid. This gave great relief. Then she fell into a prolonged sleep, from which she woke feeling much shaken, but well. One year later in 1895 she had an identical attack. Then the attacks occurred regularly every six months until the beginning of the year 1897, when she came to Queensland. In 1897 and 1898, she had similar attacks every three months. During 1899, the attacks steadily increased in number until she was having one every month. As the attacks became more frequent, so they became less severe. They came on at any time of the day or night, and had no connexion with anything which she had eaten just anteriorly : on one occasion, the attack came on just before breakfast.

While in Canada, she enjoyed perfect health between the attacks. Her appetite was then good : she was in the habit of taking plenty of meat : also bread and butter and cake between meals ; and she confesses to much candy. On arrival in Queensland, she cut down her meat in accordance with current prejudice until she was taking not more than one ounce a day. In this country she remained at first in good health between her gastric attacks, but gradually lost weight and strength as time went on.

During 1899, she consulted many medical men. Some diagnosed her case as gastric ulcer: one suggested an abdominal section, with the object, she thinks, of a more accurate diagnosis. She spent three months in a private hospital. Here, she had general massage and was kept upon a soft carbohydrate diet, chiefly Benger's Food. After leaving the private hospital, she had no vomiting or any definite attack of any kind; but she had almost constant epigastric pain and almost constant dyspepsia.

Her weight was now 6 stone $4\frac{1}{2}$ lbs., as against 8 stone 4 lbs. while in Canada. Urine 1020, acid: no albumen or sugar. Pulse 68, distinctly high tension. Physical examination disclosed no sign of organic disease anywhere.

She was dieted as under.

Breakfast.—Fish $1\frac{1}{2}$ ounce, 2 eggs. Pulled bread 1 ounce. Butter $\frac{1}{4}$ ounce.

11 A.M..—Cup hot milk, slightly diluted.

Lunch.—Meat 3 ounces. Pulled bread $1\frac{1}{2}$ ounce. Butter $\frac{1}{4}$ ounce. Baked apple with cream.

Dinner.—Same as lunch.

May 27.—Weight 6 stone $4\frac{1}{2}$ lbs. Butter increased to $\frac{1}{2}$ ounce at each meal.

May 31.—On the 28th considerable increase of epigastric pain followed a tram-ride: this continued for two days. Weight 6 stone 5 lbs. Butter increased to $\frac{2}{3}$ ounce at each meal.

June 4.—During the last four days quite free from epigastric pain. Enjoys her food, which is followed by no discomfort. Is more energetic. Weight 6 stone $5\frac{3}{4}$ lbs.

June 10.—Slight epigastric pain on 7th: otherwise well: no increase of weight.

July 1.—No pain at all since the 7th ult. One or two attacks of slight dyspepsia. Her colour is much improved and she is stronger. Weight 6 stone $6\frac{3}{4}$ lbs. During the last three weeks she has slightly increased the amount of pulled bread.

July 4.—On July 2, she was seized with an extremely violent attack of gastralgia. The pain lasted through the 3rd and into today. Vomiting has been violent and frequent. There is great cutaneous anaemia as evidenced by tightening of the radial and a general algide (almost choleraic) appearance of the face. Morphia suppository gr. $\frac{1}{2}$. At 10 P.M. the attack was over, and she was quite comfortable. This attack, which lasted about forty-four hours, was the most severe from which she ever suffered.

July 11.—Quite well since attack. She has returned to her full diet, and she has during the last few days increased in weight. She is, however, even now down to 6 stone $3\frac{1}{2}$ lbs. Urine for some days following the attack was loaded with urates: sp. gr. 1033.

July 17.—She is recovering all her lost ground with great rapidity. She is hungry, free from all pain, and enjoys perfect digestion. Thinks she has improved more during the last ten days than during the six weeks prior to her attack. Weight 6 stone 4 lbs.

After this date I was absent from Brisbane for two months and lost sight of the patient. During this time she relapsed, probably as a result of irregularities in diet and exercise.

September 13.—Weight 6 stone 1 lb. The pain in epigastrium and flatulence have returned. She is feeble and without appetite.

September 19.—It was determined to try the effect of a strict Salisbury diet for a time.

September 29.—Has been steadily going downhill: is much weaker and thinner and very miserable. She has a foul taste in her mouth, headaches, pain in lower part of sternum, flatulence, gastric and intestinal, and dyspepsia. Her loss of condition is undoubtedly due in part to the fact that, for several days, the minced beef was badly prepared, badly cooked, and indigestible. This was rectified however, and still she did not improve. Weight 5 stone 11 lbs.

October 7.—No better. Ordered to return to the diet of May 20.

December 10.—She is if anything worse at present than in October. She is bedridden and in a state of extreme neurasthenia. I was afraid to weigh her, but she must have lost many pounds. Being surrounded by anxious friends, it was deemed advisable to isolate her. She was accordingly sent into a private hospital and put under the Weir-Mitchell treatment.

For some time after admission she was kept upon milk, with about two ounces of finely divided and extremely carefully cooked minced beef. Gradually some hard carbohydrate was added, and in the course of two months she was taking a somewhat generous mixed diet. In February, March, and April, 1901, she had three simple bilious attacks at intervals of exactly five and a half weeks, each one being slighter than the previous one. Menstruation, which had been absent for some months, recommenced. Massage has been gradually abandoned, dumb-bell exercise and walking being substituted. She returned home on April 30.

May 19, 1901.—Weight 6 stone $10\frac{1}{2}$ lbs. She looks the picture of health. She is walking nearly all day. Has had no bilious attack during last six weeks. No sign of gastric pain or dyspepsia. Menses regular, rather profuse.

May 26.—Weight 6 stone 11 lbs. Menses every three weeks, rather profuse. Absolutely well.

July 12.—Weight 7 stone 1 lb. Thinks it is impossible to be in better health. Pulse 80: *distinctly lower tension than before treatment.*

July 30.—Severe bilious attack on 24th, commencing on rising in

morning, with vomiting of bilious fluid and diarrhoea, but no gastric pain. This was on the day preceding appearance of the menstrual flow.

August 30.—No attack of any sort since last note. Weight 6 stone 12½ lbs.

August 31.—Returned to Canada.

December 5.—Letter from Ontario. Is in perfect health: no bilious attacks since leaving Queensland. Continues to take meat (chiefly mince) three times daily. Carbohydrates chiefly in hard form. Weight 7 stone 5 lbs. Her friends say she is the 'picture of health.'

April 23, 1902.—Letter. Remains in perfect health. No return of bilious attacks. Continues meat three times daily: carbohydrate more various. Weight 7 stone 9 lbs.

April 24, 1903.—Letter. Remains in splendid health: no bilious attacks. Eats everything, but takes meat three times daily and avoids too much starch. Weight 8 stone 13 lbs.

Remarks.—The graduation of recurrent severe gastralgie paroxysms into continuous moderate gastralgie pain is a specific instance of the general law that recurrent efficient acarbonizing processes of all kinds tend to wear out in the course of time and to be replaced by the corresponding manifestations of unrelieved hyperpyraemia. Numberless other examples of the law are to be found in the life histories of those who have suffered from migraine, asthma, gout, etc. Probably in the case under consideration, the change was favoured, if not caused, by the change of climate and insufficient proteid. The happy and lasting effect of the Weir-Mitchell treatment emphasizes the principle that in order to obtain the best results in the treatment of hyperpyraemic affections it is essential to promote increase of decarbonizing function and not to rest content with merely restricting the carbonaceous supply.

CASE XLVIII.—*Gastralgia : dyspepsia : recurrent sick-headaches graduating into almost continuous sick-headache. Practically complete relief from diet. Under observation 2 years.*

John W—, aged 38: weight 12 stone 2 lbs.

He is an engraver, fond of reading, in which he spends most of his leisure: hates physical exercise: a teetotaller for the last seven or eight years.

About four years ago, he was dyspeptic and suffered much from flatulence and epigastric pain. On three occasions he has had violent attacks of gastralgie, associated with rigors and extreme coldness of the surface, necessitating hot bottles and 'all the blankets in the house': these attacks were not followed by any fever. When he

was accustomed to suffer from dyspepsia and gastralgic attacks, he never suffered from headache.

Of late years, he has suffered from recurrent sick-headaches. These have steadily become more frequent. At the present time he awakes nearly every morning with sick-headache: the pain is occipital and frontal, and is associated with bilious vomiting. Since he has suffered from headache, he has never had gastric pain or dyspeptic symptoms except during the headaches. Has some catarrhal pharyngitis. Pulse 80, high tension. Urine normal. Is much depressed mentally.

September 27, 1901.—Put on a small proteid diet, with half an ounce of toast at each meal.

October 12.—On September 28, usual attack in the morning: passed off more quickly than hitherto: thereafter, no headache till yesterday: toast increased to one ounce at each meal.

October 25.—No headache till to-day. Weight 11 stone $\frac{1}{4}$ lb.: toast increased to one and a half ounce at each meal.

Note made on August 13, 1903.—Had no attack, except slight occasional headaches, until March 1902, when he had a very severe one: for ten days before this attack, he had been on an ordinary diet, eating everything. In the following month, he had a second attack equally severe. From that time up to the present he has been careful, partaking very abstemiously of sugar, puddings, and pastry: he does not, however, stint himself as regards bread. As a result, he has only had about six attacks of biliousness in eighteen months. His general health, as compared with previous years, has been excellent. He is energetic and never depressed as he was before dietetic treatment. Weight 11 stone $7\frac{1}{2}$ lbs.

Remarks.—A fairly common case of hyperpyraemia from excessive carbonaceous intake with deficient physical exercise, manifesting itself in alternating forms of pathological acarbonization, graduating later into unrelieved hyperpyraemia with chronic glycogenic distension of liver.

CASE XLIX.—*Major epilepsy of six years' duration. Complete relief during treatment by diet and exercise. Under observation 1 year and 9 months.*

Johann H—, aged 31: weight 8 stone 11 lbs.: salesman.

For the last six years he has suffered from major epilepsy. At first, the fits occurred at intervals of three months: as time went on, they occurred at shorter intervals: of late, they have occurred about every three weeks. All his fits have occurred during the night while asleep: he has on many occasions bitten his tongue.

His habits are sedentary: he rises at 6 A.M. and goes to bed at 10 P.M.; and usually spends his evenings at home reading. He

always has a good appetite and never suffers from indigestion or discomfort after meals. His diet is the ordinary mixed diet : he takes a large breakfast, a midday dinner, and a light tea. He is a lifelong total abstainer from alcohol.

August 5, 1902.—Was seen by me in consultation with Dr. Hawkes, whose patient he was. He was put upon the following treatment:—

A considerable amount of vigorous muscular exercise to be taken every evening, commencing one hour after his last meal. For example, one and a half to two hours' hard walking.

Six and a half to seven hours only to be passed in bed.

Diet.—Breakfast. A full mixed meal: any class of food to be taken : the main part of sweets to be taken at this meal. Midday meal. A smaller meal than breakfast, containing more meat and less starchy foods. Evening meal. Very small meal, consisting of lean meat and not more than one ounce of toast.

Drugs.—Bromide of potassium, thirty grains at bedtime.

On June 6, 1903, the patient wrote me as follows:—‘For the first seven months, my observation of the regulations respecting exercise, diet, sleep, and medicine, has been most complete and regular. I gave up everything for the practice of them. . . . For the last two months, I have taken some little liberties with myself, giving up some evenings partly to pleasure, yet never retiring without having a stiff walk. Regarding sleep, I have lately had great difficulty in coming near the regulation. I mentioned the matter to Dr. Hawkes, with the result that the limit has been extended.’ In answer to the question as to the number of attacks since commencing treatment, he writes:—‘This question happily gives scope for the most limited remarks. One week after seeing you, I had an unfortunate attack : since then I have been completely free from them.’

In answer to this communication, I wrote on June 16 pointing out that now, when he was commencing to relax the stringency of his treatment, he ran a very considerable danger of a relapse. In reply he wrote:—‘I must thank you for your words of warning, though they came a day late for the fair. They are none the less highly prized and will be of value on future conduct.’ He had had a fit during the night of June 15. Immediately thereafter, he returned strictly to the original course of treatment.

On April 14, 1904, I again heard from him. He had remained free from fits until February 10, when he had one. For five weeks before this attack, he admits having been remiss in the matter of evening exercise. Since February, he has remained well.

Remarks.—The result in this case is the best which I have myself seen in undoubted major epilepsy. For a year or so before commencing treatment, he had had on an average one fit in twenty-one

days : subsequently, he remained absolutely free for 296 days, a fit recurring only after considerable relaxation of the treatment for two months. The fit from which he suffered one week after the first consultation in August 1902 cannot fairly be counted, since he had but just returned home by sea and had been unable to take his evening exercise. Again subsequently, he remained absolutely free for 240 days, and then suffered only after five weeks' relaxation of the treatment.

That the patient was taking one nightly half-dram dose of bromide, throughout his periods of freedom, may perhaps be held to detract from the value of the result as evidence in favour of the hyperpyraemic theory ; but as against such a contention, it must be said that he had been previously taking far larger quantities of the drug regularly for years without any marked benefit.

The favourable features in the case were the infrequency of the attacks, their purely nocturnal incidence and not too long history ; and the fact that the patient was an almost ideal patient.

CASE L.—*Frequently recurring fits of major epilepsy, alternating with outbursts of rage. Mitigation of the severity, and decrease of number, of both varieties of attacks under restriction of the carbonaceous intake.*

Mary S——, aged 24 : weight 9½ stone.

Has been epileptic for the last ten years : many fits both by day and night. On July 9, 1899, she became a patient at the Brisbane Hospital, where she was put upon heavy doses of bromides : for nine months following, she had no fits at all, but, during this time, she was extremely irritable and subject to sudden outbursts of rage, sometimes five or six a day. She also suffered at this time from very frequent and severe headaches of a congestive type : the pain affected chiefly the right eye, which became intensely blood-shot and secreted profusely.

June 11, 1900.—Bromide acne, face and shoulders : nose very red, apparently in an early stage of rosacea : mental condition decidedly epileptic : pulse 100, small, irregular, and very low tension : digestion very strong : appetite very large.

Diet ordered.—Lean meat or fish twelve ounces : bread three ounces : green non-starchy vegetables : one baked apple : tea.

The above diet was kept up for five or six weeks, more or less strictly : later, it was abandoned through poverty on the part of the parents.

The effects noted were : rapid cessation of acne and flushing of the nose, the skin becoming quite clear and fresh : headache of all kinds quite ceased : she became much less irritable, and though the fits of temper continued, they were only half as frequent and less

violent: convulsive attacks were reduced about 50 per cent. in number, and they became at the same time much less severe.

During the last fortnight of the treatment, she was taking ten grains of bromide thrice daily: during this time she had an interval of nine days without an attack.

Remarks.—It is hardly probable that any further improvement would have accrued from continuance of the diet. Under it, she lost weight rather rapidly: hence it might not have been possible to enforce a severer restriction without some injury to her physical health. It was evident that the convulsions were pathologically prepotent to a marked degree, as indeed are probably the great majority of epilepsies in which the fits are frequent and the blood-pressure habitually low (compare § 747). The power of the diet to enhance the action of bromide was conspicuous.

CASE LI.—*Minor epileptic attacks due to high blood-pressure. Complete relief by restriction of carbonaceous intake and exercise. Under observation 8 months.*

M. R—, aged 61 years: weight 12 stone 3 lbs.

He is a rather plethoric professional man, who has an excellent appetite which he indulges, a strong digestion which never plays him false, and an antipathy to physical exercise. For some time latterly, he has suffered from 'seizures' or 'spells.' These come on without warning or apparent cause, and at any time. They consist of a momentary sense of 'dazedness' or modification of consciousness. He has also been troubled with sudden flushes of the face and with insomnia. He is organically sound: urine normal: pulse 60, large, regular, and somewhat incompressible.

September 1901.—He was treated by halving his daily intake of food: no alteration was made in the nature of his diet except that sugar was cut off: exercise was insisted on.

As a result, the flushings and seizures ceased: and he slept well through the night.

April 14, 1902.—A month ago he became sleepless again, and a week ago his other symptoms returned. Inquiry elicited the fact that he had relapsed into his old food habits and had neglected exercise.

He was put upon the same treatment, but his dietetic restrictions were specified in greater detail and put on paper: also he was ordered five-grain doses of iodide of potassium thrice daily.

Note made on April 23, 1902.—All his symptoms disappeared within a week after recommencing treatment. His pulse is now more compressible.

Remarks.—Broadbent draws a sharp distinction between high and low blood-pressure convulsions (§ 745). Low blood-pressure convul-

sions—that is, convulsions associated with habitual low blood-pressure—constitute essential epilepsy; and essential epilepsy may consist of major and minor attacks. It seems probable that the attacks, in this case, were minor variations of high blood-pressure convulsions. At any rate, they ceased concurrently with reduction of the blood-pressure.

CASE LII (communicated by Dr. Hawkes).—*Frequent epileptic fits (minor) of lifelong recurrence. Marked relief by seton, diet, and exercise.*

Mary T—, aged 26.

Has been epileptic since early childhood. At puberty she became worse, and since then there have been exacerbations at the onset of each menstrual period. The fits consist of sudden loss of consciousness: she occasionally falls and hurts herself slightly. She has been saturated at various times with bromides without much benefit. Her attacks on coming under treatment averaged two or three daily: only very rarely did she remain free for a whole day.

She was very dull mentally, and this, combined with an increase in the number of fits, had made it impossible for her to retain any place as domestic servant.

Her diet at home had been very poor, consisting chiefly of bread and treacle: she rarely had meat.

Treatment.—A seton was inserted in the right hypochondriac region. She was put upon a diet consisting of $\frac{3}{4}$ lb. of meat and 3 pints of milk, with bread restricted to 4 ounces daily. Physical exercise was insisted upon: for some months, she walked regularly between three and eight miles daily. No medicine of any kind was given except an occasional purgative.

The fits gradually decreased in severity and number, until at the end of about five months she remained free except at the onset of the menstrual period: then she had two or three attacks consisting of sudden loss of consciousness without any convulsion—‘faints’ as she calls them. She also became much brighter mentally, and for the last three months has been earning her living as a domestic servant. The seton was removed nine months after its insertion. It is too soon at present to say whether this will be followed by any relapse; but such seems most probable.

CASE LIII.—*Pre-menstrual epilepsy at long intervals. Relief apparently due to diet and regular exercise. Under observation 3 $\frac{3}{4}$ years.*

Mary B—, aged 25: rather thin.

Had convulsions when teething: during childhood, had a fit about every month, during which she frequently bit her tongue. Between

ages of 8 and 14, she was at school and had no fits at all: does not think she took more exercise then than at other periods, but *became excessively fat*. Fits recurred about age of 14 concurrently with puberty: for following two years, had a fit about every month. They came on almost invariably two days before the appearance of the menstrual flow: on one occasion only, when the flow was on: never after the flow had ceased. Between ages of 16 and 18, fits fell to one in about three months. From the age of 18 to the present time (January 1901), she has been free for periods of two years, and then has two fits separated by about six weeks. These attacks have always occurred at the end of summer, namely in February or March. Last attacks in March 1900. She has been taking bromide for the last eight years.

Treatment.—Regular exercise, such as walking, tennis, etc. Cease sugar: reduce starch foods to minimum consistent with maintenance of body-weight. N.B. This amount turned out to be about four ounces per diem. Bromide 30 grs. per diem.

April 16, 1901.—Slight fit on going to sleep. Menstrual period commenced this morning. *Yesterday evening, she ate some trifle*: this was her first lapse since she commenced dieting. Since she has been under her present treatment, her menstrual periods have been free from all symptoms: ‘she would not know her condition except for the show’: previously, she suffered considerably from sacral and hypogastric pain.

September 17, 1901.—Slight fit at 12.30 P.M.: this attack was inter-menstrual: *she had partaken of shortbread the day before*. Weight 8 stone 13 lbs.

Note made in February 1904.—No attacks since last note. She has been careful in diet and has taken regular exercise.

Note made in April 1904.—No further attacks.

Remarks.—This case taken by itself would of course be valueless as evidence. It is quite likely that the fits were ceasing spontaneously when treatment was commenced; and it may be that they will recur. Still it seems significant that the only two attacks from which she suffered were both preceded by errors of diet; and dietetic errors when menstruation was imminent would of course be doubly dangerous. The relief of dysmenorrhoea by treatment such as the above is common.

CASE LIV.—Epilepsy, mainly minor, tending to alternate with asthma. Relief from asthma by diet.

Mrs. Mary E. H—, aged 51: very thin.

Always enjoyed good health until fifteen years ago, when she was travelling in America. She was then attacked by asthma quite suddenly while walking during the forenoon. After this for some

years she had three or four short paroxysms daily. The attacks have gradually become less frequent of late years: during the last three they have almost left her until the last three months, when they have again been frequent and more severe. Her worst paroxysm is always at 3 A.M.

She is also epileptic. Her first fit was the year after she commenced to be asthmatic, that is, fourteen years ago. She then remained free for a year. On coming to Brisbane, she commenced to have three or four fits daily for the week preceding menstruation, remaining free for the remaining three weeks. This went on for six years, when the fits became less regular. The fits were never violent except on two occasions. They are now hardly noticeable to a bystander and consist only of a momentary loss of consciousness, not always complete. During last two months, she has been taking bromide and the fits have been much less frequent. She has felt very muddled in her head, however, and her asthma has been much worse. Generally speaking, when her fits are worse, her asthma is better, and conversely; but both kinds of attack have been severe on the same day occasionally.

She was put on a small proteid diet, with three ounces of starch foods, a little butter, milk, and green vegetables. On this diet, she ceased practically to suffer from asthma, without any exacerbation of her minor epilepsy: indeed, the latter was, if anything, rendered less frequent.

Remarks.—This is the patient referred to in § 506.

CASE LV (communicated by Dr. A. J. Turner).—*Epileptic seizures from injudicious diet. Complete relief by modification of diet. Under observation 5 months.*

On November 18, 1903, I was called in to see a girl aged two years and nine months, who had on my arrival just recovered from an attack of convulsions. I found a healthy-looking well-developed girl, an only child, evidently spoilt, who was being fed with chocolate creams as I came in. Physical examination showed nothing. Inquiry into the seizures showed that they were slight convulsive seizures of short duration with loss of consciousness, and typically epileptic in character. She had had five attacks in all, the first nine months ago: the intervals have been decreasing, the last having been six weeks. Her diet appears to have been most injudicious: she has been pampered with sweet things, and given a great deal of chocolate creams and other sweetmeats.

Consistently before each attack of convulsions, she has for some time completely lost all appetite.

I ordered a strict diet, sugar to be excluded or given in minimal quantities: no sweets: starchy food to be restricted. Also an occa-

sional dose of calomel, with greater restriction of food (milk only advised) if she got an attack of anorexia.

On April 23, 1904, her mother called to report progress. She informed me that sweetmeats had been entirely stopped, and that her diet had been careful compared with her previous diet. I gathered, however, that it had not been as strict as that which I had prescribed. She had had calomel occasionally. There had been no attacks and the child appeared to be in perfect health.

Remarks by the author of this work.—Loss of appetite of some duration, with or without more overt dyspeptic manifestations, not infrequently antecedes epileptic attacks, especially where the fits occur in series at comparatively long intervals. The same is true of many cases of recurrent mania. In both cases, it is apt to be assumed that the neurosyal attacks depend upon the gastric disorder. Nor are we justified in entirely excluding this sequence. But the most consistent view is that there is a slowly accumulating hyperpyraemia, manifested in the first place by glycogenic distension of the liver and secondary anorexia and dyspepsia, in the second by decarbonizing convulsions or mania.

Cases such as the one above described by Dr. Turner are distinctly encouraging. The humoral factor in epilepsy being recognized, they seem to show that in cases in which the attacks are infrequent and of but recent origin—in cases, that is, which have not become pathologically prepotent through a long accentuated ‘memory of the body’—we may hope to eradicate the tendency to convulsive decarbonization by substitutive physiological acarbonizing measures. In my experience, sweets are amongst the commonest causes of recurring convulsions in children; and I have met several mothers who recognize this fact.

CASE LVI.—*Recurrent paroxysmal vertigo or minor epilepsy, with nocturnal diuresis and post-nasal catarrh, following asthma. Seton 7 months: partial relief from paroxysmal affections: cessation of post-nasal catarrh: marked diminution of menstrual flow. Removal of seton: relapse at all points. Reinsertion of seton: re-establishment of improved condition. Under observation 13 months.*

Miss R—, aged 24: saleswoman: rather thin.

From the age of 3 to 20, she suffered from bronchitis (probably asthma) every winter: the symptoms were worse at night, when she would often have to sit up for some hours wheezing: this occurred nearly every night through the winter. She also suffered from nasopharyngeal catarrh, for which her ‘nose was burnt’ at about the age of 20. For the two years between the ages of 20 and 22, she was well in most respects, except that she continued to suffer from post-

nasal catarrh. Never suffered from bilious attacks or headaches of any kind. She has a good appetite and a strong digestion.

Two years ago while she was sitting at table, sudden flushing of the face followed by pallor and vomiting came on. A week later while she was going up some steps after dinner, she suddenly fell with a sensation of falling down a great depth: when she recovered, which she did almost instantaneously, her face was very red. She had then no further attacks for twelve months.

One year ago she began to wake every morning between three and four with distension of the bladder: then she would rise and in doing so had intense feeling of giddiness with sense of falling from a height. These symptoms continued to recur for three or four weeks. Then the nasal cautery was used and relief followed: for a time she suffered from attacks only about every month.

For the last six months she has been worse again. She has sometimes three or four attacks every day: these consist of sudden vertigo with inclination to fall upon her face: they come on without any warning and do not seem to be connected with the menstrual periods.

Some months ago, she was put upon a diet consisting mainly of meat and bread: she was also ordered to take regular exercise. This treatment, however, was followed out very imperfectly. The bread was not limited in amount, and as she had to earn her living in a shop from 9 A.M. to 6 P.M., exercise to any extent was out of the question.

Accordingly on July 12, 1902, Dr. Hawkes inserted a seton in the left infra-mammary region.

Subsequent history.—After the insertion of the seton she steadily improved until she only had attacks on the average once a week: on one occasion she went a fortnight without any attacks. The great majority of her attacks were much less severe than formerly: she only had two severe attacks while wearing the seton. There was a marked influence upon menstruation and also upon the post-nasal catarrh. The menstrual flow, which had lasted five days, lasted only three days; and the daily loss was much less in amount. The post-nasal catarrh, from which she had suffered practically all her life, began to get less in a month after the insertion of the seton: it ceased during the second month. The seton worked out in seven months.

During the succeeding five months, her vertiginous attacks increased slowly until she was again having two attacks a week on the average. Also her post-nasal catarrh returned and the menstrual losses increased.

At the end of the five months, namely, on August 30, 1903, another seton was inserted at her own request. Two days later she had an unusually violent vertiginous attack.

September 28.—There has been no attack since. The nocturnal diuresis has ceased : she sleeps through the night.

Remarks.—Clearly the paroxysmal attacks (whether we regard them as vertiginous or epileptic), the nocturnal diuresis, and the chronic post-nasal catarrh, depended upon hyperpyraemia, the mechanism of the first two, at least, being essentially vaso-motor. Hence the salutary influence of the increased combustion, associated with the continuous slight pyrexia due to the seton. The inverse relations between katabolic and haemorrhagic decarbonization were well marked.

CASE LVII.—*Paroxysmal vertigo : slight bronchial catarrh : obesity. Rapid cessation of the first two affections under moderate carbonaceous restriction. Under observation 9 months.*

Mrs. K——, aged 56: weight 16 stone 9 lbs.

In January 1890, she weighed 13 stone 10 lbs. During the last nine years, she has been gaining about one stone every summer and losing a rather less amount every winter. She has never suffered from headaches or any recurrent affection until last summer: in fact she has been a remarkably healthy woman, the reverse of neurotic.

Last summer, she commenced to suffer from giddiness, violent at times, coming on in paroxysms, and frequently causing her to fall in the street. She rarely hurt herself, however, as she always had warning sufficient to give her time to hold on to something or at any rate to fall gently. The attacks were associated with intense flushing of the face, which would go scarlet quite suddenly. She was greatly perturbed because she feared that her neighbours suspected her of indulging in alcohol: this was perhaps the more annoying in that she was, and had always been, practically a total abstainer. This last summer during which she had suffered from vertigo, was the first of a long series during which she had not increased in weight.

Since the winter began she has been much better: she now feels giddy and reels a little on first rising in the morning, but that is all. She has a slight bronchial catarrh.

July 17, 1900.—Sugar was cut off, and starch foods reduced to four ounces per diem. Fish and meat were allowed *ad lib.*

The bronchial catarrh and the morning vertigo ceased in the course of a week.

September 27.—Weight 14 stone 11 lbs.: no recurrence of symptoms.

March 13, 1901.—She had no trace of vertigo through the summer. Has ceased dieting: weight 15 stone 3 lbs.

Remarks.—Probably the vertigo and bronchial catarrh represented a very slight tendency to hyperpyraemia depending on the fact that she had reached the limit of her fat-forming capacity.

Hence the rapid cessation of these affections under moderate carbonaceous restriction.

CASE LVIII.—*Immoderate obesity: migraine: secondary dyspepsia: chronic bronchial catarrh: articular gout: uro-lithiasis. Diet. Complete relief from all affections. Under observation 4 years.*

Maurice B—, aged 44: weight 24 stone 4 lbs.: height 5 ft. 9 ins.

Began to get stout about the age of 26: at 32 weighed 17 stone: during the last year he has practically ceased to increase in weight.

Has been subject for some years to 'biliary headaches.' These occur irregularly for the most part, but can always be induced by a supper containing much saccharine matter, such as sweet fruits, ginger ale, etc. The headache is hemicranial and affects especially the left eyeball: it is present on waking in the morning; and has recurred every day for weeks. Sometimes it is followed by biliary vomiting.

He usually wakes in the morning with a bad and sour taste in the mouth and with a coated tongue.

Every winter he suffers from bronchial catarrh, which is worse when waking in the morning, at which time he brings up much phlegm: on several occasions he has had distinct wheezing during the night. He has suffered from these bronchial symptoms for twenty or twenty-five years: they were more severe when he was about 16 stone than at present.

One year ago, he was attacked by gout in the metatarso-phalangeal joint of the right big toe: there were distinct swelling and redness and great tenderness, but no severe pain: he could walk through the attack, which lasted about a week. Three weeks ago he had a second attack identical in all respects.

For the last year he has noticed that his urine always deposited on standing a heavy reddish-brown sediment. This may have been present previously without his knowledge.

Most of the above symptoms have been worse during the last year, that is, since his weight has become stationary. He has also been very sleepy after every meal except breakfast; and during sleep at night, he has snored in so distressing a manner that on several occasions his wife, fearing he would choke, felt constrained to arouse him.

He is extremely plethoric, his conjunctivae, nose, and face generally being much injected and presenting many distended venules: his skin, especially of the nose and adjoining area, is markedly shiny and oily in appearance.

On March 9, 1900, he was put upon a diet consisting mainly of

fish and lean meat, with green non-starchy vegetables and a little fruit: his starch foods were cut down to three ounces daily; and he was ordered to drink hot water between meals in considerable quantity.

During the first week he lost 14 lbs. in weight. Thereafter, the weight loss was continuous but diminishing. *March 28, 22 stone 5 lbs. : April 3, 22 stone : April 11, 21 stone 9 lbs. : April 17, 21 stone 6 lbs. : April 26, 21 stone : May 9, 20 stone 4½ lbs. : May 27, 19 stone 8 lbs. : July 2, 18 stone 7 lbs. : September 14, 17 stone 6 lbs. : January 5, 1901, 15 stone 9 lbs.* Total loss in nine months, 8 stone 9 lbs.

In April 1900, about one month after commencing treatment, he had a very slight attack of gout in the toe joint previously affected: this was his third attack: it lasted three days only and has not recurred. In September 1900, he suffered from an attack of muscular rheumatism in the interscapular region: this lasted for a week. In the November following a curious mishap occurred. He had fallen in weight to nearly 16 stone when he suddenly got an inguinal hernia for which he had to wear a truss. I suppose the canal had been distended and blocked by a plug of fat, and when this became absorbed, a knuckle of intestine descended. At any rate, when in a few years' time he again became obese, the bowel remained in the abdomen and he was enabled to dispense with the truss.

Otherwise under treatment his general condition improved very conspicuously. His 'biliary headaches' ceased at once and did not return. His tongue cleaned and he awoke each morning fresh and without any unpleasant taste in his mouth. Through the whole of the winter of 1900, he remained for the first time for over twenty years entirely free from bronchial symptoms of any kind. His urine remained clear and free from all deposit even on prolonged standing: it was always strongly acid and usually of a specific gravity of 1022. His complexion underwent a very marked alteration: the skin, especially of the nose, became clear, much paler, and ceased to show distended venules and to be greasy: his conjunctivae became white instead of bloodshot. He experienced a great increase of energy: his meals no longer made him sleepy; and he slept through the night without snoring to any distressing extent.

Later on old food habits got the better of him, and he is now, I imagine, well over 20 stone once more.

Remarks.—This case illustrates clearly many points in the theory of hyperpyrexia. The patient was endowed with a hearty appetite and a sound digestion, both possibly dependent in part upon a low degree of the glycogenic function of the liver. His ruling vice was a passion for sugar; his saving capacity, a truly remarkable power of rapid fat-formation. Hence, though his grossly erroneous food

habits led to many of the manifestations of hyperpyraemia, namely, migraine, secondary dyspepsia, articular gout, chronic bronchial catarrh, and gravel, yet these were for the most part of quite moderate severity. They doubtless represented a narrow margin of carbonaceous excess in the blood, and they were readily dispersable by reduction of the strain upon his acarbonizing functions.

It is the occurrence of arthritic gout in circumstances such as were present in this case, that seems to make it improbable that the hyperpyraemia which leads up to the gouty paroxysm consists in a mere quantitative increase of pyraemia. For in this case the last gouty paroxysm occurred several weeks after the commencement of acarbonizing treatment, at a time when the patient was rapidly losing weight and when it seems unlikely that a mere quantitative increase of physiological pyraemia could have persisted. Possibly the prolonged hyperpyraemia which seems necessary for the production of arthritic gout, results in the development and accumulation in the blood of some carbonaceous compound, more stable in nature than any of those carbonaceous compounds which constitute the normal carbon contents of the blood (compare §§ 196 and 955).

CASE LIX.—*Subacute articular gout and obesity. Diet. Induction of acute gout with subsequent freedom for a time. Relief of obesity. Under observation 9 months.*

Ralph P—, aged 46: weight 15 stone 10 lbs.: height 6 feet 2 ins.

Fourteen years ago, he had his first attack of gout in the big toe. Since then he has had six or seven attacks. Both big toes, both ankles, both knees, and one wrist have been attacked by acute inflammation. Some of the phalangeal joints of the hands are enlarged, but in none of these has there ever been any acute inflammation.

He had served through a great part of the Boer war and then enjoyed a remarkable immunity from gouty manifestations of all kinds: indeed he never felt better in his life than then.

On account of his gout, he had been almost a vegetarian for years, and to this he ascribed his obesity. He now regarded his gout which was hereditary as incurable, but he wished to have his weight reduced. When he consulted me, he was suffering from subacute gouty inflammation of the left wrist: urine pale, clear, and copious, sp. gr. 1015: no albumen.

Accordingly on November 10, 1901, he was put upon a small fish and meat diet, with green non-starchy vegetables, and his starch foods were reduced to one and a half ounce per diem.

November 15.—His wrist had been distinctly more inflamed and painful since the change of diet, though it was now a little easier: he took some sal colchicum on the day before. Previously he had had

some slight gouty pains in many joints : these had ceased and the inflammation seemed to have become concentrated in the wrist. Urine acid, sp. gr. 1020 : no albumen or deposit.

November 26.—The wrist suddenly ceased to be painful. On November 27, he was suddenly seized with sharp pain and inflammation of the right knee : this was most marked at the insertion of the ligamentum patellae. His meat diet was stopped and he was ordered to take milk and soda only.

Between November 27 and December 9, he had a severe and very acute attack of gouty inflammation in the knee, with considerable effusion into the synovial cavity. The pain on the latter date had nearly passed away : he felt '*very weak but extremely well*' : urine 1025 : no albumen.

A few days later he was put back upon his original small meat and fish diet.

On February 4, 1902, he weighed 13 stone 10 lbs., and had remained quite well.

On July 4, he was still continuing substantially the same diet : weight 13 stone 5 lbs.

Subsequent history.—He remained in perfect health until April 1904, when he had a severe attack of gout in the knee. He had, however, left Queensland some eight or nine months ; and I am unable to vouch for the conditions which preceded this attack.

Remarks.—I do not think that there can be any doubt but that the severe and acute attack of gout which came on, on November 26, 1901, was due to the substitution, for his ordinary largely carbohydrate diet, of the mainly animal (meat and fish) diet, adapted to reduce obesity. The existence at the time of subacute gouty arthritis in the wrist was an indication of hyperpyraemia and uricaemia ; and the change of diet would necessarily increase the introduction into the system of uric acid-forming material. In such circumstances, the extreme probability of accentuating arthritic manifestations must always be borne in mind. If it is desired to avoid such an occurrence, probably a proteid diet deficient in uric acid-forming material, such as milk and eggs, should be prescribed. At the same time, it is an open question whether the induction of the acute gouty paroxysm was not actually salutary and cut short the continuance of arthritic symptoms. Duckworth considers it justifiable on some occasions to precipitate acute gout, and recommends to that end a pint of champagne. This case also shows that a diet containing much uric acid-forming material may be given without inducing arthritic attacks when an acute gouty paroxysm has dispersed hyperpyraemia.

CASE LX.—*High blood-pressure with compensatory intermittence of the heart-beat: slight bronchial catarrh. Rapid and complete relief by restriction of carbonaceous intake and exercise.*

George F—, aged 67 : weight 14 stone 4 lbs.

He had an abscess of the liver three years ago : this opened into the bowel and ended in recovery.

He has had a tendency to catarrh of the bronchi most of his life. This has been worse during the last six years. Some wheezing begins as soon as he lies down at night: also, a dry hacking cough. He has been told by a medical man that he has fatty degeneration of the heart: he suffers from dyspnoea when he walks uphill.

September 22, 1902.—Auscultation. There are a few sibilant rhonchi and mucous râles over both chests, especially at the bases. First sound of heart, rather indistinct: second, distinctly accentuated. His pulse presents the characters of high tension: it intermits every fourth beat. Has a hearty appetite and a good digestion. No albuminuria. He was ordered gentle exercise especially in the evening, and put upon the following diet :—

Breakfast.—Fish, chop, or steak, 3 to 4 ounces.

Toast or bread, 1 ounce with a little butter.

Tea with milk but no sugar.

Lunch.—Meat 4 ounces.

One small potato.

Green vegetables except peas.

Toast or bread 1 ounce.

Dinner.—Clear soup.

Fish or meat or both, in all 4 to 5 ounces.

One small potato.

Green vegetables except peas.

Toast or bread 1 ounce.

One or two baked apples.

Alcohol in form of whisky limited to 3 ounces per day.

September 27.—Weight 14 stone 3 lbs. Heart acting with perfect regularity: pulse large and full: can walk uphill or upstairs without dyspnoea or praecordial distress. His cough is now quite loose: there are a few mucous râles but no dry sounds. Heart's second sound still accentuated.

October 4.—Weight 14 stone $3\frac{1}{2}$ lbs. Appears to be quite well subjectively and objectively.

Remarks.—It is not often that hyperpyraemic manifestations are dispersed with so much facility as in this case. The patient was a man of robust fibre and great physical strength; and probably the margin of carbonaceous material in the blood constituting the hyperpyraemia was narrow. This margin however, narrow as it was, led to exaggerated arterial tone, compensatory intermittence of the heart-

beat and slight tendency to asthmatic acarbonization. The additional blood-pressure involved in hill-climbing naturally caused palpitation and dyspnoea.

CASE LXI.—*Chronic catarrh of fauces, naso-pharynx, and larynx : severe acne : irregularly recurrent bilious attacks. Rapid and complete relief by diet only.*

Miss S—, aged 24 : weight 8 stone 8 lbs.

Has suffered from irregular bilious attacks since childhood : these, she thinks, could always be traced to some error of diet. A year ago she took to office work : since then she has been worse. During the last five months she has had an attack at least once a week usually on Sunday. The pain is present on waking : it is bilateral but worse on the right side and especially in the right eye. She always has anorexia and usually vomiting. Menses regular : they seem to have no influence on the attacks.

She is greatly disfigured with acne : the pimples suppurate and amount to boils in many places.

She also suffers more or less constantly from catarrh or congestion of the fauces and naso-pharynx : her tonsils are enlarged and congested : uvula, oedematous and much elongated : pharynx, granular and presenting varicosity of the veins. There is also laryngeal catarrh. She is learning singing, and her throat is a source of great anxiety to her : she has undergone much local treatment at the hands of a specialist without any lasting benefit.

Her food habits are flagrantly wrong : she confesses to an almost uncontrollable passion for sugar. She has a large appetite and except when 'bilious' never suffers from any dyspeptic symptom.

Treatment.—She was put upon a diet consisting of fish and lean meat, with green non-starchy vegetables : sugar was interdicted, and starch-foods cut down at first to three ounces, later to four ounces per diem.

As a result her bilious attacks almost immediately ceased. Six weeks after the beginning of the treatment she had only lost 2 lbs. in weight. Her acne had completely disappeared. Her fauces, uvula, naso-pharynx, and larynx had ceased from troubling her ; and seemed to me on examination to be all practically normal except for some remaining varicosity of the veins.

Two months later I again saw her. She had abandoned treatment and was eating anything and everything. Her diet now differed from her original diet before treatment only in the fact that she continued to take some meat or fish at each meal.

The results of this backsliding were interesting. Her bilious attacks had not returned : this perhaps was to be explained by the fact that she was increasing in weight with great rapidity : in the

two months, she had increased nearly 2 stone. Her acne, however, had returned and was as bad as, if not worse than, ever; and her throat was again showing signs of congestion. Later, by a strong effort, she returned to a moderately strict diet and rapidly convalesced in all respects.

Remarks.—There is no doubt that in this case the recurrent ‘biliary attacks’ were physiologically prepotent, just as, I am inclined to believe, are most paroxysmal neuroses complicated by acne or other dermatoses not of vaso-motor mechanism, or by a marked tendency to *embonpoint* (§§ 576 to 577). The congestion of the upper respiratory passages disappeared in this case more rapidly than usual: this also is to be explained by the existence of a very powerful fat-forming capacity and by the fact that the respiratory manifestations arose only under a grossly excessive carbonaceous intake.

CASE LXII.—*Chronic bronchitis of ten years' duration dating from menopause: hemicranial complications: varicose veins: discolouration of skin: commencing alopecia. Cure and relief by diet only. Under observation 5 years.*

Mary S—, aged 56: single: weight 11½ stone: inclined to be stout: occupation domestic servant.

Was quite well until ten years ago when the menopause occurred. She then began gradually to suffer from cough, expectoration, and shortness of breath. For the last six years, she has awoke nearly every morning at 4 A.M. with cough and dyspnoea: thereafter until she rises, she is unable to lie down, but has to prop herself up with pillows. For the last two years, whenever her breathing was much affected, she has suffered severely from pain in the right side of the face, right ear, and right side of the neck, associated with a sensation of throbbing at the vertex; also, her eyes have been bloodshot and her legs considerably swollen. The swelling of the legs is associated with some varicosity of the veins: it is painful: most marked towards evening, and seems to depend upon the varicose veins. Lately, her hair has been coming out in combfuls; and her face and neck have become discoloured with ‘muddy brown patches.’

She has been constantly under medical treatment for the ten years, and has consistently spent practically the whole of her wages in doctors' fees and druggists' bills. Most of her medical advisers treated her with medicine only. The only advice she received concerning food was to avoid much butcher's meat: this she was only too ready to do. Before commencing the treatment of her case, I sent her to Dr. Francis, in order to see if his method of intranasal cauterization would have any beneficial effect. She attended for a few weeks, but the result was only temporary relief.

On examination, her chest, which remained shapely, presented the

usual signs of chronic bronchitis, namely, disseminated mucous râles and sibilant rhonchi. Her cough was sometimes dry, especially in the early morning, but more often moist, when she would expectorate a large amount of muco-purulent phlegm.

There was nothing to note about her habitual diet: it was the ordinary mixed diet, with tea and bread and butter between meals.

Treatment consisted of diet only. She was ordered to take lean meat with green non-starchy vegetables: to avoid sugar; and to restrict starch foods to half an ounce of toast with a little butter at each meal. This treatment commenced on May 28, 1899.

Improvement began at the end of one week and was rapid for the three weeks following. At the end of four weeks, most of her symptoms had disappeared: she coughed only once or twice in the morning: had no wheezing, and slept undisturbed throughout the night. Her headaches had disappeared; so also had the pains in her legs and the swelling towards evening: the varicosity of the veins was much less marked and her hair had ceased to come out. She was much more energetic: her work no longer troubled her; and she began of her own accord to take frequent walking exercise.

July 7.—By this date all her symptoms had disappeared and she regarded herself as absolutely well. Consequently, as commonly happens, she began to be careless in the matter of diet. Soon she began to suffer from symptoms of laryngeal catarrh, and gradually all her symptoms returned, including cough, nocturnal dyspnoea, pains, loss of hair, etc. This attack lasted six weeks; and then, under a return to strict dietary, gradually subsided.

November 16.—For last eight weeks she has been absolutely well in all respects. She compares this record with her average condition during the last ten years, during which time she was never free from dyspnoea continuously for more than one week, and that while taking drugs. She has lost all her pains: the skin of her face has returned to its normal colour, and her hair has ceased to fall. Her weight is $10\frac{1}{2}$ stone.

I called to see her on October 1, 1903 (four years and four months after she was first dieted). She was, and had been since last note, absolutely free from all chest symptoms. Her chest is quite clear, and she never suffers from headache or pains elsewhere: she sleeps through the whole night. Her skin is clear and free from all discolouration: she has a fresh growth of hair and looks very considerably younger now at the age of 60 than four years ago.

It must be admitted, however, that this patient has some exceptional advantages. She is a servant at the house of the patient referred to in Case VI. This gentleman and his wife continue the diet system under which he was originally relieved of his recurrent bilious attacks. Consequently, there is little temptation in the house

to err in the matter of food. And on inquiry I find that on the average she takes about four ounces per diem of starch foods : sugar she never touches. Her weight remains constant at $10\frac{1}{2}$ stone.

April 1904.—Remains well in all respects.

Remarks.—This case might be classified as one of unrelieved hyperpyraemia dating from, and due to, the menopause, with bronchial, venous, cutaneous, and neuralgic manifestations. Such cases arising so late in life and of so long duration, are in my experience practically incurable by treatment which ignores the food factor. They are on the other hand—at least in the well-nourished—readily amenable to the treatment followed in this case.

CASE LXIII.—*Chronic bronchitis with asthmatic paroxysms, following congestion of the larynx with laryngismus : uro-lithiasis. Complete convalescence on two occasions under diet and exercise. Under observation $3\frac{1}{2}$ years.*

William B_____, aged 40 : broad-shouldered and well-built politician. Weight, 10 stone 12 lbs.

From the age of 28 to 34, suffered much from 'congestion of the larynx' : his symptoms were pain, cough, hoarseness, and aphonia. He also had violent spasms during which he would become 'black in the face and struggle for breath' for, perhaps, twenty minutes or half an hour at a time. Most of these symptoms disappeared after his arrival from the old country in Queensland, although his occupation, entailing as it does much platform speaking, leads to hoarseness at times.

Six months ago, he had an attack of influenza, with cough, which gradually assumed the form of 'asthma and bronchitis.' For some time past, his morning urine has deposited a heavy reddish-brown sand : it is habitually high-coloured and strong-smelling.

Auscultation shows numerous dry and moist sounds scattered all over both lungs : his chest is well formed : there is no permanent expansion. He is now always more or less wheezy : cough is frequent and violent, often followed by vomiting, but rarely leading to expectoration. He sleeps moderately well until about 3 A.M. Then he is awakened by increasing dyspnoea, and thenceforward he has to assume a semi-recumbent attitude. The dyspnoea moderates before breakfast, but any sudden exertion will reinduce it throughout the day : consequently he has practically abandoned exercise. During the six months that he has suffered, he has lost nearly $1\frac{1}{2}$ stone in weight.

His habitual diet is as follows :—

Breakfast.—Meat, eggs, two rounds of toast or bread : tea with milk and sugar.

Midday meal.—Meat, potatoes and other vegetables : tea with milk and sugar : no bread or puddings.

Evening meal.—Meat, bread, butter, jam, tea, etc.

He rarely takes puddings and then only rice : is very fond of sugar : takes two heaped-up teaspoonfuls to each cup of tea, of which he has about six per diem : his daily allowance of sugar probably amounts to six ounces. He has always been a practical teetotaller : of late, he has taken a little alcohol by his physician's order. He has been treated by four medical men : most of these warned him against eating much meat : two cauterized his nose internally, and this gave some temporary relief. He is never dyspeptic.

On December 11, 1900, he had had asthmatic attacks every night for nearly six months. He was ordered to increase the amount of proteid and to make it the staple of each of his three meals : to cease sugar and fat, except a very little butter ; and to cut down his starch food to two ounces of toast daily. Also to take iodide of potassium, gr. xv. ter die ; and cease alcohol.

He commenced this treatment on the morning of the 12th.

December 13.—Very bad attack in morning at usual hour.

December 14.—Bad attack, but not so severe as yesterday. Through a misunderstanding he has been eating rather largely of potatoes and tomatoes.

December 15.—Asthmatic dyspnoea this morning lasted only two hours.

December 16.—This morning the dyspnoea failed to wake him at the usual hour. Later at 5.30 A.M. when he did awake, there was present slight wheezing, but *this only towards the end of a long expiration.*

December 17.—Same experience as yesterday.

For the last three days, his urine has been pale, clear, with no deposit, and free from its previous rank smell. He has had hardly any cough since the commencement of treatment. To take iodide twice a day only.

December 20.—Still improving.

Shortly after this date, he went to Sydney. On and after December 31 he ceased absolutely to suffer from cough, wheezing, dyspnoea, or any other chest symptom. His wind for bicycle riding became as good as it had ever been.

About January 5, he returned to his ordinary diet, except that he still continued to avoid potatoes, sugar, pork, and puddings. On January 8, he stopped the iodide. Later, he returned to his full original diet, taking all foods indiscriminately. On January 24 he weighed 10 stone 13 lbs.

In March 1902, fourteen months later, he remained absolutely well.

May 25, 1903.—Up to this date he had remained in perfect health. Then he had an attack of 'influenza,' with headache, backache, and general pains. The influenza 'went to his chest.' Wheezing returned and he was troubled with an exceedingly violent paroxysmal cough.

June 9.—Dieted as before, but toast reduced to one and a half ounce per diem. He was ordered also to take exercise thrice daily, especially in the evening. *No drugs of any kind.*

June 13.—He is considerably better as regards his chest. Has been walking from eight to ten miles a day. Complains of feeling a little weakness and trembling in the legs. As this symptom sometimes depends on deficient carbohydrate, his allowance of toast was increased from one and a half to three ounces per diem.

June 18.—As the increase of toast seemed to increase the severity of his chest symptoms, he returned to his original allowance, namely one and a half ounce. He improved immediately.

June 24.—Yesterday morning was extremely cold (36° F.) and his paroxysmal cough was very severe: he improved considerably towards the evening.

July 1.—All his symptoms ceased rather suddenly on June 25, and he has remained quite well since. After the above date he gradually relaxed his dietetic restrictions, but continued exercise.

March, 1904.—Remained well ever since.

Remarks.—His last attack, beginning on May 25, 1903, seemed identical with his first attack, which lasted six months before he came under dietetic treatment; and it seems to me highly probable that it would have persisted and become chronic without the radical treatment to which he was subjected. This treatment took exactly fourteen days to render his chest completely clear: doubtless the rather severe exercise which he imposed upon himself accelerated the cure.

The prior occurrence of attacks of laryngeal dyspnoea bears out the view expressed in § 650, that this spasmodic affection is sometimes due to vascular distension of the larynx, from hyperpyraemia—that it is, in short, a 'laryngeal asthma.'

CASE LXIV.—*Chronic bronchitis of 12 months' duration. Cure by diet and exercise.*

Charles August D——, aged 14 years.

Nine months ago, he got very wet, caught a chill, and had an attack of acute bronchitis with considerable fever. He has suffered from chronic bronchitis ever since. He has been for two months an out-patient, and for a fortnight an in-patient, at a large Queensland Hospital. His case was diagnosed as phthisis and he was sent to me in my capacity as Hospital Inspector for admission into the

Consumptive Sanatorium at Dalby. His cough is almost constant : expectoration semi-purulent, about six ounces per diem, mostly at night.

Physical examination.—Nutrition poor : is markedly pigeon-breasted and undersized : over both lungs are disseminated dry and moist bronchitic sounds. He has much dyspnoea on the slightest exertion. Bacteriological examination shows the sputa to be free from tubercle bacilli. Pulse high tension, very incompressible : no night sweats : no pyrexia. His habitual diet is almost solely carbohydrate : he rarely touches meat, which he heartily dislikes.

Treatment.—To remain in open air all day, and take as much physical exercise as possible without inducing severe dyspnoea : to sleep with all windows open through the night.

Diet.—Meat, fish, eggs, milk, and green non-starchy vegetables : one half-ounce of bread in twenty-four hours : no other carbohydrates.

October 30, 1900.—(Seven days after commencement of treatment.) Better in all respects than for some months : sleeps well : cough much less : expectoration not more than two ounces in twenty-four hours. His pulse is now easily obliterated.

November 6.—He has relapsed during the last three days : this is apparently due to two causes. The weather has been extremely hot, overcast and thundery ; and he has been careless in dietetic matters.

November 13.—A little better but not much : he has still been guilty of many dietetic errors. Diet revised and written out in full : ordered to take ten grains of iodide of potassium every four hours.

November 20.—Has been keeping strictly to diet since last attendance : iodide has been taken thrice daily only. Is nearly well. To cease iodide and continue diet.

January 28, 1901.—Has remained absolutely well since last note. Physical examination shows chest to be quite free from all adventitious sounds : plays cricket every evening : is always hungry for meals : eats absolutely no bread.

March 1901.—Remains well and strong : he has modified his diet considerably, but he still takes some proteid at each meal : he is now well nourished.

Remarks.—The treatment took exactly four weeks to free the chest from bronchitic manifestations. The first half of this time was practically wasted, so that it is likely that, with strict diet from the start, the result would have been very rapid. The iodide doubtless assisted materially. The case and its result are typical of many. The favourable prognostic points were youth and the comparatively short duration (nine months) of the affection.

CASE LXV.—*Chronic bronchitis 13 years: asthma 11 years: permanent expansion of chest. Some relief from diet and exercise.*

Lawrence S—, aged 37: weight 8 stone: very thin. Has always had a weak chest, that is to say, has been liable to colds on the chest from slight causes. In the year 1888, while in England, he suffered from acute bronchitis which kept him in bed two or three weeks. He came to Queensland in consequence. He remained more or less 'wheezy' until 1890, when he began to suffer from severe paroxysmal asthma almost every morning about four. During last year, the paroxysms have been getting much milder, but he is now constantly wheezy: of late 4 P.M. has been his worst time. He has tried many physicians and many drugs: *intranasal cauterization was applied for four months.* He has twice suffered from dengue: on both occasions he enjoyed complete cessation of his chest symptoms. His customary diet is as follows:—

Breakfast.—Porridge, bacon, and eggs, bread or toast and butter.

11 A.M.—Bread and butter with jam.

Dinner.—Soup, fish, meat, potatoes, bread and butter.

Tea.—Meat, bread and butter, jam, etc.

He is very fond of bread, which he eats in considerable quantities. He suffers at times from flatulent dyspepsia.

He walks about three miles on every day of the week. Should he miss his exercise or lie down and sleep during the day, he has an asthmatic exacerbation. He is very distinctly worse in summer, especially during the S.E. or sea breeze. He has never found any district or place which affected his asthma favourably.

He expectorates much phlegm, especially in the morning and afternoon. Auscultation discloses a few râles, with dry sibili over both chests. He is round-shouldered and presents typical asthmatic conformation, there being *permanent expansion of the chest.* There is injection of the conjunctival capillaries.

July 5, 1901.—Ordered to continue walking exercises, also to go through a mild course of Sandow's exercises.

Diet.—Fish, lean meat, occasionally eggs, three times daily. Carbohydrates reduced to a daily allowance of one and a half ounce of toast, with a little butter.

July 11.—Feels very well: expectorates a good deal, but finds his breathing much freer: can walk quicker and with less discomfort than at any time during the last twelve months.

July 15.—Weight 7 stone $12\frac{1}{2}$ lbs. Improvement continues: congestion of conjunctivae has disappeared.

July 18.—Weight 7 stone 12 lbs. Steady improvement: says he can walk at the rate of five miles per hour: much less expectoration: for last two days, none: he has ceased to suffer from flatulence.

July 22.—Yesterday was Sunday. At his midday lunch he took

a glass of beer, and instead of his customary exercise went to sleep at 2 p.m. At 3.30 he awoke with distinct, but moderate, asthmatic dyspnoea, which persisted throughout the remainder of the day, and disturbed him during the night. Weight 7 stone 12 lbs.

August 5.—On July 29, he was allowed, in addition to his ordinary diet, some porridge and milk for breakfast. On August 1 in the evening at dinner time, the asthma returned and was rather severe through the night, so much so that he was induced to inhale some Himrod's Cure twice. This, as had happened on several occasions before, brought on rather severe diarrhoea which lasted through August 2 and 3. This diarrhoea necessitated the cessation of the meat diet: it left him rather weak and somewhat disheartened, so that he practically abandoned the treatment, and I saw him no more.

Remarks.—Had he persisted, I am inclined to think that a further degree of amelioration would have occurred and could have been maintained with great care. But there were many conditions hostile to complete recovery: amongst these, the permanent expansion of the chest, his extreme leanness, and a lack of determination. The permission to take porridge and milk at breakfast was a distinct error of judgment, more especially in view of the fact that his most asthmatic hour was 4 p.m. I have seen no other case in which Himrod's Cure induced diarrhoea.

CASE LXVI.—*Chronic bronchitis, a legacy from recurrent asthma. Complete cure by diet and exercise. Under observation 8 years.*

Mrs. F——, aged 41: weight 12 stone 12 lbs.

During the summer of 1895 in North Queensland, she had a sharp attack of dengue fever. Four or five days after the crisis of the fever, she began to suffer from dry cough and wheezing. This gradually developed into most severe paroxysmal asthma: the paroxysms through the night were, I think, the most violent and prolonged I have ever seen; but she did not obtain complete freedom during any part of the day. The affection continued for many months with rare intervals, but varying in intensity. Many of the paroxysms were so violent and so prolonged that extreme cardiac dilatation, fortunately always recovered from, occurred. The only drug which gave relief was iodide of potassium given in heroic doses, I think as much as grs. lx. every four hours, at one period of her illness.

As nothing seemed to give more than the most temporary relief, it was decided to try the effect of a sea-voyage. Accordingly she sailed for Scotland. She suffered more or less on the voyage, and was on the whole worse after arriving in that country. After some months' absence, she returned to North Queensland, quite as bad as when she left.

Later she discovered a spot in the country, a small dairy farm,

only eight miles removed from her residence, where she remained free from the violent nocturnal asthmatic paroxysms. On returning thence, she relapsed somewhat but not severely, and gradually her affection settled down into the condition presented when she came under dietetic treatment. She was then a typical bronchitic but without permanent expansion of the chest: well-nourished, indeed rather stout, and presenting râles and sibili over both chests anteriorly and posteriorly. She always felt 'stuffed up' and had dyspnoea on the slightest exertion. Only rarely however was she called upon to sit up at night. She was at her worst for the two days preceding menstruation: at her best, during and just after a period. She had tried some longish walks and found that, although her dyspnoea increased at first, her breathing became markedly free thereafter.

In April 1901, I met her by accident in Brisbane, and having ascertained that, though much better, she was still a sufferer to the above extent, suggested dietetic treatment. She readily consented. She was ordered to take three meals daily: to make the chief portion of each of lean meat, white fish, and occasionally eggs: to take green non-starchy vegetables *ad lib.*; and to restrict her carbohydrates to three ounces per diem, none being taken with the last meal of the day. Also to take as much walking exercise as possible without distress, commencing slowly and gradually increasing her pace as the breathing became freer; it was impressed upon her that exercise taken in the evening after the last meal was of more value than exercise at any other time of day.

She commenced treatment on April 10 and continued until the beginning of July, when I saw her. She had fallen in weight to 10 stone 1 lb. She informed me that her chest symptoms had steadily declined until six weeks after commencement of treatment, by which time she was practically well. In July, she was absolutely well in all respects: she could walk four or five miles very fast without the least distress: had no cough or wheezing; and this for the first time for six years, i.e. since her first attack which followed dengue.

On April 14, 1902, in answer to a letter of inquiry, her husband wrote:—‘She has had no return of the old trouble, consequently has not had to return to the treatment. Her weight at the present time is 10 stone 3 lbs., she is enjoying excellent health, and still continues to take plenty of outdoor exercise.’

September 1903.—Remains quite well.

March 1904.—Remained quite well until last month, when I am informed she had a recurrence of her extremely violent asthma. This was about two years and a half after she had given up dietetic treatment as unnecessary. I was not connected with the case during this attack.

Remarks.--This case illustrates what seems to be a fairly well-defined rule, namely, that asthmatics in whom the affection has degenerated into a continuous catarrh are, in the absence of permanent expansion and other structural alterations, more amenable to treatment by diet and exercise, than in the paroxysmal stage. Not only so, but the relief afforded seems to be, other things equal, more enduring. A favourable feature of the case was the existence of a well-developed fat-forming capacity.

CASE LXVII.—*Chronic bronchitis with asthmatic paroxysms. Relief by underfeeding.*

Thomas R—, aged 43: weight $10\frac{1}{2}$ stone.

Nine years ago he caught a cold when camping out in the bush. Severe asthma began between 1 and 2 A.M. This recurred every night for thirteen weeks. Later he convalesced and remained well for several months. Since then he has suffered from asthma more or less constantly. On one occasion during a paroxysm, he coughed up about a pint of pure blood: immediately thereafter the dyspnoea ceased.

On admission into the Diamantina Hospital, the patient was well nourished, indeed a little inclined to be corpulent. Auscultation disclosed general dry and moist râles over both lungs. Other organs healthy: there was no permanent distension of the chest. There was a loose cough throughout the day, with asthmatic dyspnoea at night.

This case turned out to be interesting, if not amusing. The patient was an inveterate benevolent-asylum loafer, whose main object in life was to remain just so much of an invalid as was necessary to enable him to claim comfortable board and lodging at the expense of the State. His previous diet had been very largely starchy and saccharine. On admission, he was put upon a mainly proteid diet, his carbohydrate intake being cut down to three ounces per diem. On this his chest affection steadily abated to his intense disgust, until at the end of a fortnight he could sleep uninterruptedly through the night and his expectoration had fallen from three ounces to one ounce in the twenty-four hours. Râles however were still distinguishable.

Under the improvement in his condition he became seriously alarmed, foreseeing apparently that at no distant date he would be able to work for a living. Accordingly, he determined to starve himself to some extent. He consistently refused his dinner and took but very little at his morning and evening meals. *The result was the rapid and complete subsidence of all bronchial symptoms and signs.*

CASE LXVIII.—*Chronic purulent bronchorrhœa. Rapid and complete relief by restriction of carbohydrate intake with increase of proteinid.*

Amelia N—, aged 17: weight 9 stone 10 lbs.

Has suffered for four years with cough and profuse purulent expectoration. Has never had any asthmatic symptoms, cough always being loose: she is, however, short of breath on exertion.

August 2, 1902.—She is very fat and has an excellent colour and a clear skin. Good expansion at both apices. Auscultation disclosed moist râles all over both lungs, most marked at the bases. The expectoration amounted to about eight ounces daily: it presented very little aëration, and was hardly distinguishable from the pus of an acute abscess. Microscopically, there were numerous staphylococci, no bacilli.

Her diet had been mainly of starch foods: she was extremely fond of sweets and was plentifully supplied therewith.

She was directed to take some meat at each meal: to avoid sugar and all articles of food containing sugar: and to take not more than four ounces of starch food per diem. Under this diet, she rapidly improved and was fully convalescent in a few weeks.

Remarks.—One might almost regard the profuse expectoration in such a case as a direct overflow.

CASE LXIX.—*Rheumatoid arthritis, amenorrhœa, and anaemia, due to deficiency of proteinid. Complete convalescence under diet. Under observation 2 years.*

Elizabeth A—, aged 18½ years: weight 8 stone.

Menstruation commenced at age of 16: she remained regular and in good health until January 1901, when her periods suddenly ceased. During the six months prior to the cessation of menstruation she had been living near Cairns, North Queensland, with her father, who was a prospector in a small mining settlement where there was no butcher. The district was hot and moist, and her diet consisted of porridge, bread and butter, potatoes, cabbage, jam, treacle, and tea, with occasionally a little meat.

About a week before her last menstrual period, her ankles began, quite insidiously, to ache, with slight but increasing swelling towards evening. Three or four weeks later, both wrists became affected on the same day: at first they ached only slightly but gradually got worse. A week or so after her wrists were attacked, she noticed swelling of all the first phalangeal joints of both hands, excepting the thumbs, which have never been at all affected. The enlarged phalangeal joints have never given her the slightest pain, though they were slightly tender to firm pressure.

Of late, she has had fortnightly exacerbations of pain, heat, and

swelling, in the ankles and wrists. The exacerbations on alternate fortnights are the more severe : she thinks these correspond to her missing menstrual periods. The exacerbations last from two to four days : the wrists are chiefly and always affected ; the ankles sometimes escape. Her hands are habitually cold and moist, even during the exacerbations, and her fingers more especially so. Her wrists, however, are habitually hot, but hotter during exacerbations. For the last four months, she has been very subject to colds in the head : these were especially severe about once a fortnight when she was suffering under the arthritic exacerbations.

On admission to the Diamantina Hospital on August 7, 1901, she was anaemic and thin. Her wrists and ankles were swollen and tender. The former presented tender spots over the anterior annular ligament and over the dorsal aspect of the lower end of the ulna. First phalangeal joints of fingers enlarged and slightly tender to firm pinching.

She was ordered the following diet: twelve ounces of meat or fish : three ounces of bread and butter : two pints of milk ; and green vegetables (non-starchy) *ad lib.* A fortnight after admission, she was put on cod-liver oil, at first one ounce, later three ounces, daily.

She had slight exacerbations lasting a few days on August 16 and 22, and on September 5 and 13. On September 29, menses reappeared : next day the right wrist was more than usually swollen and painful. From October 2 to 4, her joints were all worse than usual and she was generally ill and had to remain in bed. October 28 and December 2, menses lasting four days. She had one slight exacerbation in January 1902.

In February 1902 she was appointed housemaid to the hospital. Her weight had then increased to 9 stone 10 lbs., and she seemed well in all respects : her hands were still inclined to be cold, but were not moist.

Note made in April 1902.—Absolutely well since last note : menses regular : is a very hard worker : now eats anything she likes, but never misses meat, fish, or eggs, with each meal.

Note made in September 1903.—Still retains her appointment and remains in perfect health. A little roughness is to be detected in the wrist joints on careful examination.

Remarks.—This case has been referred to in the body of the work (§ 848). It seems to me to have been a typical case of chronic progressive rheumatoid polyarthritis, whether we consider its etiology, symptomatology, or physical signs. The history of its onset alone practically precludes an error of diagnosis. This being admitted, we must cease to regard this disease as incurable, though a fairly early diagnosis will doubtless remain an essential condition of therapeutic success.

CASE LXX.—*Chronic rheumatoid polyarthritis of 12 months' duration. Convalescence, practically complete, under diet alone. Under observation 17 months.*

Alfred M—, aged 19: weight 8 stone 7 lbs.

Always enjoyed good health until October 1901, when he had an attack of appendicitis. This however was not severe: he only remained away from his work for a fortnight in consequence. Thereafter, he remained in good health until the following December.

During December 1901, he began to feel something wrong with his right knee-joint. At first the sensation hardly amounted to pain, and the trouble commenced so insidiously that he could not say on what day it started. Soon however the joint began to be painful on walking, and in the course of a few weeks there was distinct swelling. He concluded he must have twisted it or sprained it in some way unknowingly.

Some few weeks after the commencement of the trouble in his right knee, his left knee became affected in exactly the same way. The pain, which was barely perceptible at first, steadily increased in the course of a few weeks, and later steadily increasing swelling occurred.

A few weeks after the involvement of the left knee, his right ankle became insidiously involved, and later swelling supervened.

This was followed by involvement of his left ankle, which followed a similar course.

The next joint to become affected was the first phalangeal joint of the middle finger of his right hand. There was little pain here, only tenderness, and swelling came on gradually.

Next the left wrist was affected and followed a similar course; and thereafter, the right elbow, right hip-joint, the 'soles of his feet,' the temporo-maxillary joint, and the joints of his cervical spine—all these became painful on movement and more or less stiff. The commencement of trouble in all these sites was insidious: he cannot say in what order, or exactly when, these parts became affected.

He had been under treatment by two medical men. The first had given him medicines and had *warned him strongly against taking more than a very little meat.* The second had ordered general vapour baths. These he remained in for from fifteen to twenty minutes; and they were repeated three times a week for two months. The baths were followed by some relief for about an hour, after which he was as bad as before.

His habitual diet consisted of not more than three ounces of meat or fish per diem, with much starch foods: he was especially fond of porridge and pudding, and took much sugar in all forms.

On December 12, 1902, Dr. Hawkes sent this patient to me, considering it to be a typical case of chronic rheumatoid polyarthritis.

On this date his weight was 8 stone 7 lbs.: and he was distinctly anaemic. On examination both knee-joints were considerably enlarged: there was some little fluid in the synovial cavities, but the enlargement seemed to be mainly extra-synovial, and it was 'doughy.' There was marked wasting of the muscles of the thigh, more especially of the lower part just above the knee-joint. There was swelling affecting both ankle-joints: his feet generally were 'shapeless.' The first phalangeal joint of the middle finger of his right hand was very greatly enlarged, markedly deformed indeed; and his left wrist was oedematous. His right elbow was a little enlarged and he was unable to extend it fully. There was stiffness of both temporo-maxillary joints, and he was unable to open his mouth more than halfway. He held his head rigid, rotation and flexion being very limited.

All his joints were more or less tender to pressure, and most of them presented abnormal sensations to the examining hand on voluntary movement. Thus there was an abnormal degree of creaking sensation when the leg was very slowly extended upon the thigh: this was taken to indicate loss of polish on the posterior aspect of the patella and perhaps on the opposed articular surfaces of the femur. A similar sign existed in the left wrist. On opening the mouth there was creaking of the temporo-maxillary articulation: on rotating the head, the same apparently in the atlanto-axial joints.

He had practically ceased to walk, taking a tramcar even for a hundred yards. His employers were on the point of discharging him, as he had become almost useless. At this time he was at his worst: there had been absolutely no improvement in any of his joints: indeed he was rapidly stiffening in them all. He remained however *practically free from all pain so long as he kept at complete rest.*

He was ordered the following diet:—

Breakfast.—Four ounces of underdone meat or of fish.

One ounce of hard toast with butter.

A little stewed fruit or raw apples.

One pint of milk.

Lunch.—Three ounces of meat, fish, or oysters.

One ounce hard toast with butter.

Half ounce of cheese.

Some green vegetables excepting peas.

One pint of milk.

Dinner.—A little clear soup.

Three or four ounces of fish or meat.

One ounce of hard toast with butter.

Green vegetables except peas: tomatoes occasionally.

One ounce of cheese.

A little stewed fruit or raw apple.

One pint of milk.

Supper.—One pint of milk.

On January 13, 1903, i.e. one month from the commencement of treatment, I saw him again. He then thought there was some improvement, but this had only appeared during the last three or four days. Weight 9 stone $1\frac{1}{2}$ lb. He had been taking a little sugar with his stewed fruit. This was stopped, also the cheese.

February 10, 1903.—The improvement which seemed to set in on the 10th of last month has been more than maintained. Weight 9 stone $3\frac{1}{4}$ lbs. Toast increased to two ounces at each meal.

October 6, 1903.—Weight 10 stone $2\frac{1}{2}$ lbs. *He has adhered most rigidly to the diet prescribed.* Since he commenced to improve almost exactly nine months ago, his improvement has been continuous without a single set-back. He is now well and strong: no trace of anaemia. He is able to walk almost any distance without pain in the knees or ankles. He has had a holiday in the bush, where he frequently spent four or five hours walking over a rough road on the ranges. He has also done a good deal of bicycling.

I made a careful examination of his joints. The phalangeal joint referred to is still enlarged, but very much less so than before: firm pinching still elicits slight tenderness. His left wrist is slightly tender to firm pressure over the radio-carpal joint, but is not at all swollen. His right elbow will not permit of full extension, but there is no pain or tenderness in it. All his other joints seem to be absolutely well. Nothing abnormal can be detected in the ankles and knees. All muscular wasting has disappeared: indeed the muscles of the thigh, which had presented such marked wasting, are now exceptionally well developed: the lower portion of the vastus internus presents the well-known hypertrophic development common to those who do much bicycling. This I regard as the most unequivocal sign of restoration of the joint surfaces, especially of the patellar joint surface. He can open his mouth widely and rotate his head freely.

Remarks.—The mode of invasion, the progressive nature of the joint disorder, the involvement of a phalangeal joint and of the temporo-maxillary and atlanto-axial joints, together with the absence of all febrile movement throughout, seem to render it certain that this was a typical case of chronic rheumatoid arthritis or polyarthritis, which affection has been so often spoken of as the 'despair of the physician.' It is noteworthy that the diet under which this terrible disorder invaded, and made good its position in, the organism, was essentially the diet which is regarded by the general public and, I think, by the great majority of the medical profession, as simple, unstimulating, and harmless. No drugs were given, and no alteration in his surroundings or mode of life was made, other than the alteration in his diet. Up to the alteration of diet, deterioration was continuous: shortly thereafter amelioration set in and was continuous.

Consequently, it seems beyond dispute that the result was due to

the alteration of diet, which, from the standpoint of the theory of hyperpyraemia, was of course fundamental. The circumstances which, in my opinion, determined the extremely favourable nature of the result, were the youth of the subject and the fact that the disease was comparatively recent (twelve months), but perhaps even more important, the intelligent determination of the patient.

CASE LXXI.—*Chronic general rheumatoid arthritis. Relief from all pain by diet. Under observation 16 months.*

Robert R—, aged 32: weight about 10 stone.

In 1897, he was a miner in Charters Towers, North Queensland, and had always enjoyed excellent health. Then he went to Townsville, where he took to cabdriving. He had an excellent appetite and digestion, and was a moderate beer drinker. Under the loss of exercise involved in his new occupation, he put on weight rather rapidly; and he got into the habit of sleeping heavily for an hour or so after his midday dinner. In May 1901, he was attacked by rheumatoid arthritis in the left knee. Later, other joints were attacked in the following order:—Right knee, left shoulder, right shoulder, left elbow, right elbow, both wrists simultaneously, right ankle, left ankle: all the joints of his hands and fingers, his hip-joints and the joints of the cervical spine have become involved, but he is unable to say exactly at what period. In each case, the disorder commenced insidiously and was steadily progressive.

On admission into the Diamantina Hospital on December 29, 1902, all the joints of his body were apparently involved, most of them being considerably enlarged and tender: there was marked muscular wasting: his knees were doughy; and there was contraction of the hamstrings on both sides but not sufficient to prevent him from standing. His rest at night had been greatly disturbed by articular pains for many months.

He was ordered hot and cold douching, and massage to the larger joints; and put upon the following daily diet:—Twelve ounces of meat or fish: three ounces of starch foods, such as bread or potatoes: two pints of milk: green non-starchy vegetables: tea or coffee, without sugar: butter was allowed.

On this treatment, the articular pains and tenderness steadily subsided, until in the course of a few weeks he could sleep uninterruptedly through the night without narcotics of any kind. But he had lost seven or eight pounds in weight. He was then put upon cod-liver oil, at first one ounce daily, later three ounces. On this addition, he regained his lost weight and more, continuing free from all pain, except when he moved about. He remained in hospital seven months, and on leaving was able to walk a few hundred yards without discomfort and with a stick only. The improvement how-

ever was limited to his general health and to his subjective symptoms. The joints presented practically the same appearance as on admission.

Three months later, he was readmitted. While away he had lived at his own home. There, he had less meat and considerably more bread and potatoes: the only sweet foods he indulged in were some buns. At first, he remained under this altered diet as well as at the hospital; *but after four weeks* he began to go wrong. All his joints became painful and their swelling increased. He again began to suffer from insomnia, due to the nocturnal pain. On readmission, it was quite apparent that he had become anaemic, much thinner, and greatly depressed mentally. Whereas on leaving hospital he had been able to walk comfortably with the assistance of crutches, he was now unable to stand at all.

After readmission, he was put back upon his old treatment; but on this occasion, it was quite *eight weeks* before distinct improvement set in. Only after eight weeks was he able to sleep comfortably through the night, whereas, on his first admission, he had attained to this stage within three weeks. He is now (three months after readmission) improving steadily, but he is still far from being as well as on his discharge. He is however absolutely free from all pain except on movement.

Remarks.—Improvement in general health, relief from pain, and a moderate locomotive power, are, I think, all that can be expected in this case.

CASE LXXII.—*Chronic general rheumatoid arthritis. Relief from pain and lameness by diet. Under observation 8 years.*

Mrs. F —, aged 31 years.

As a child she suffered from whooping-cough, bronchitis, and abscesses in the glands of the neck and under the knee. In the year 1893, when twenty-two, began to suffer from 'rheumatism,' at first in the back under the right shoulder-blade: this was dispersed by rubbing. About a month later, her left hand became affected rather suddenly: she woke up one morning and found that she could not use it: the first phalangeal joints were red and very painful. A few days later, the corresponding shoulder-joint was attacked.

Six months later, the left knee went wrong in the same way: 'pain and inflammation' were present on waking. The pain was not severe: stiffness and incapacity would better describe the condition. Swelling came on gradually. About this time, she had some indications of trouble in the left hip-joint; but these were slight and lasted but a few days.

Some months later, the right knee was attacked ; and her feet and ankles have given her trouble at times.

In the year 1896, she left South Africa, where she had lived for many years, and came to live in North Queensland. From then until 1898, she was under my treatment. Her left knee was enormously swollen and evidently contained considerable fluid. There was no swelling of the right knee, which, however, presented distinct signs of erosion of the cartilages at the back of the patella and of the femur and tibia. Her left wrist was practically immovable, and all the phalangeal joints of both hands more or less enlarged and slightly tender. During these two years, her condition remained almost stationary. Though she was under my treatment, I was quite unable to help her at that time and told her so.

After February 1898, she seemed to become gradually worse, suffering more pain and becoming more helpless.

In February 1900, she left for the old country. While at home, she was treated by Dr. Shiels of Glasgow, who prescribed general massage and put her on a special form of diet : this was a generous mixed diet however. Under this treatment, she improved markedly : she was able to walk a mile without sticks, half a mile with perfect comfort.

In January 1901, she left England for Queensland by the eastern route. During the first half of the voyage, she remained moderately well, but shortly after leaving Colombo she began to go downhill, and shortly after her arrival in North Queensland she was laid up altogether.

On March 24, 1901, she entered a private hospital in Brisbane to be under my care. She was then just able to stand and could only move very slowly across the room by the aid of a pair of crutches. The fluid in the left knee-joint had become much less, but there was great pain on attempting flexion, and the articular surfaces seemed to be destitute of cartilage.

For the first fortnight of her stay in hospital, she was put upon the Salisbury diet, namely, six ounces of minced beef three times daily, with hot water *ad lib.* between meals. During this fortnight, she passed red gravel almost every day.

For the next six weeks, the mince was varied with fish, and one and a half ounce of toast with a little butter was added to the daily diet. She was also allowed tea and coffee with a little milk but no sugar. General massage was practised daily. During the eight weeks, her weight fell from 7 stone 6 lbs. to 7 stone $3\frac{1}{2}$ lbs. ; and there was some slight improvement in the condition of her joints. She continued to pass uric-acid gravel, however, two or three times a week.

On May 28, 1901, she returned home to North Queensland and

for the succeeding three months continued the same dietetic treatment. A change now came over her symptoms : from having been more or less continuous, the pain and sub-inflammatory joint manifestations became periodic. These recurred every fortnight to the day, commencing on Friday and ending on Monday : during these days, there was some return of the synovial effusion in the left knee. The attacks on alternate fortnights were pre-menstrual, the exacerbations of symptoms commencing two days before the flow appeared and ceasing somewhat suddenly on the establishment of the flow : on the second day of menstruation, she was almost at her best. During these three months, she continued to pass gravel at times ; and she also had some headaches, to which she was unaccustomed.

On August 1, meat and fish were reduced to between three and four ounces at each meal, and the bread increased to about one ounce. Eggs were allowed occasionally to take the place of an equal weight of cooked lean meat. Vegetables containing no starch or sugar were added. As a result of this modification in the diet, she ceased to pass gravel : her headaches had already ceased.

During this month, the *inter-menstrual* attacks became less severe and ceased. During the following month and thereafter, the *menstrual* attacks became steadily less severe.

In August, she gave up the use of crutches.

In October, she gave up the use of a stick.

April 24, 1902.—She visited Brisbane. She has not used a stick now for six months. The only pain she suffers is a slight pre-menstrual attack in the knee and wrist, or occasionally after some special physical exertion. She is about on her feet all day and walks very well, although slowly and with a barely perceptible limp. She can manage a mile with only slight pain towards the end of her walk. The left knee, which a year ago was still somewhat boggy and swollen, has now settled down so that only bony enlargement remains. Comparing her present condition with her condition while in England, she thinks that her joints are equally good, if not better, while she feels more energetic.

She has made some observations upon the influence of sugar which seem to me of the highest importance. She says that in her case, there is not the least room for doubt as to the prejudicial effect of this food-stuff upon her joints. On several different occasions, she has taken a small piece of preserved ginger, a single cup of tea with sugar, and a few muscatel grapes ; and invariably she has suffered on the following day from a distinct attack of heat and pain in one or more joints, which heat and pain have endured into the following night. She has noticed also a slight return of gravel on these occasions.

July 1903.—Her condition remains much the same. She suffers

very little pain, her chief complaint being weakness in the left knee-joint. She is somewhat anaemic and depressed from the prolonged heat of last summer. She was ordered a considerable increase of fats, especially butter.

On August 30, 1903, she wrote saying that the last alteration in her diet had had a markedly beneficial effect upon her appearance and general health ; and that the joint condition remained as well as before.

In April 1904, I happened to be in North Queensland and visited this patient. She had strictly adhered to the dietetic rules. Improvement had been continuous. She remained quite free from pain, except after some extra amount of walking. The *weakness* of her legs had been much less of late. Her wrists had become more moveable : this was probably due to driving herself about in a pony cart. She had felt the heat of the last summer less than of any other in North Queensland. She had only made one dietetic error for many months. She ate two chocolate biscuits, and next day she had marked neuralgic pain in one thigh, probably due to some accentuation of arthritis in the corresponding hip-joint.

Remarks.—This case illustrates very clearly the extremely prejudicial influence of tropical heat, especially when prolonged, upon an already developed rheumatoid arthritis, and the benefit which so commonly accrues from a change to a cool climate. These effects of heat and cold being admitted, we must appraise very highly the therapeutic power of the dietetic plan pursued when we consider that the results were obtained *in spite of continued residence in North Queensland through a more than usually hot summer (1901-1902).*

In another similar case, I would now increase the allowance of fats at an earlier stage of the treatment ; nor would I permit so large an intake of meat. The prejudicial influence of sugar on the arthritis was peculiarly well marked—to my mind, unmistakable.

CASE LXXIII.—*Climacteric depression with other nervous and biliary symptoms. Complete relief by restriction of carbonaceous intake.*

Mrs. C—, aged 46: weight 11 stone 11 lbs.

Three months ago, her menstrual period came on at the usual time, but the loss was very slight: six weeks later, there was another slight loss. During these last three months, she has been greatly depressed : she has had many fits of crying for which she could not account. She has been much annoyed by hot flushes up and down her back : she has had frequent palpitation of the heart on slight exertion, or even without exertion : she has felt constantly *bilious* and her skin and conjunctivae are distinctly yellow.

She was put upon a small lean meat diet, with green non-starchy

vegetables, starch foods being reduced to three ounces per diem and all sugar and alcohol being interdicted.

A week later, she had greatly improved. Her depression had lifted : she had no inclination to cry. The hot flushes were still present, but were much less frequent, namely, four times in the week as against four times daily previously. She had suffered from palpitation only on three occasions and it was slight.

A month later, she was still improving though the flushes still recurred : palpitation even on exertion had ceased.

A month later still, she seemed well in all respects.

Remarks.—The patient presented most of the psychical, nervous, and hepatic symptoms common to the menopause. They were all explicable by hyperpyraemia, or by consequent disordered vaso-motor action or glycogenic distension of the liver. The obvious treatment, namely, restriction of the carbonaceous intake, was long ago successfully practised by Tilt (§ 176).

CASE LXXIV.—*Angio-neurotic oedema 10 years : dyspepsia 20 years : slight obesity : slight rosacea : irritability. Rapid and complete relief by diet. Under observation 4 years.*

John O'S——, aged 34: medical man.

He has been almost constantly dyspeptic for twenty years, his special symptoms being flatulence, heartburn, and substernal pain. Ten years ago, he returned to Australia from London, where he had taken his diploma. Shortly after his arrival, he began to suffer from urticaria. This was of the giant type : the wheals were on some occasions as large as a pudding-plate : sometimes his tongue and fauces became so swollen that he feared tracheotomy would be necessary. He had a long hospital experience, and he assured me he had never seen a case anything like as bad as his own.

The eruption was always induced by eating fish, especially shell-fish : and, as he was a Catholic, the attacks invariably came on on Saturday or Sunday.

During the last few years, he had increased considerably in weight. His face had become somewhat bloated-looking and greasy ; and he suffered from a slight tendency to acne rosacea, although extremely abstemious in the matter of alcohol. He had become irritable and somewhat bad-tempered.

Treatment.—Sugar and all soft carbohydrates were cut off ; and he was ordered a diet consisting of meat, baked toast, and well-boiled green vegetables : tea with milk and saccharin was allowed, but no fluid with meals.

Two months later he had lost a stone in weight, and there was a great improvement in his appearance and general condition. Dyspepsia ceased at once and recurred only when he made some

gross departure from the diet scale. His complexion became clear and fresh. He lost all irritability and increased greatly in energy, physical and mental. He looked and felt at the least ten years younger. But perhaps the most remarkable result was that oysters, prawns, crab, and fish, which with an ordinary mixed diet never failed to induce a severe attack of giant urticaria, quite ceased to have any such effect.

Note made four years after commencement of treatment.—Remains in good health. Has slight dyspepsia occasionally, but can always account for it. The angio-neurotic symptoms have never recurred.

Remarks.—Such cases are commonly explained in some such way as the following:—Primary gastric dyspepsia causing irritability of temper, reflex rosacea, and angio-neurotic oedema from development of toxins and subsequent toxæmia. My own view favours the following explanation:—Hyperpyraæmia, giving rise directly to irritability and rosacea: secondary dyspepsia from glycogenic distension of the liver: angio-neurotic oedema from toxæmia resulting from disordered metabolism of fish-foods under hyperpyraæmic conditions. We cannot ascribe the last affection directly to hyperpyraæmia, since it exclusively followed certain special articles of diet. The hyperpyraæmia depended on a carbonaceous intake which was relatively excessive, and the obesity indicated a partially successful attempt at decarbonization.

CASE LXXV.—*Widespread eczema, rapidly dispersed by moderate restriction of carbonaceous intake: relapse induced deliberately by increased carbonaceous intake: re-convalescence.*

Humphrey M—, aged 52: weight 13 stone $4\frac{1}{2}$ lbs.

A rather corpulent working man who has been unable to work of late on account of his affection. Has always enjoyed good general health, and his skin was quite clear until August 1901. Then he began to experience irritation in both legs; soon the skin became inflamed, broken, and scabbed. In December 1901, his arms became similarly affected; and in January 1902 his neck and face.

March 3, 1902.—Admitted to Diamantina Hospital. On admission the eruption affected both thighs, anteriorly and posteriorly: both legs in their circumference: the anterior aspect of the neck from the manubrium to the chin: both arms and both forearms on the flexor aspects; and almost the whole of the face. His eyelids were much swollen.

He was put upon a diet consisting of meat and green non-starchy vegetables, with bread limited to three ounces daily: no external applications were made.

March 18.—Very much better.

March 30.—The only eruption remaining consists of a few cir-

cumscribed patches on forehead and left eyelid; and these are manifestly healing rapidly.

April 2.—Skin quite clear everywhere: weight 12 stone 11 lbs.

This patient had come straight from North Queensland, and in conversation with him I gathered that he considered his convalescence really due to the cooler climate of the south. As it seemed expedient for him to understand his own case, I put him on an ordinary mixed diet, including sugar and jam, and did not restrict him in any way. Fourteen days later, i.e. on April 16, the eczema had reappeared on the anterior surface of the left wrist, the flexure of the right elbow, and one eyelid. As the weather was then even cooler than on his convalescence, he was satisfied; and returned to his restricted diet.

April 23.—Discharged well.

Subsequent history.—In the following June, I accidentally met this patient, and he informed me that about a fortnight after his discharge his eczema returned and shortly became as bad as on his admission. This was under indiscriminate eating and in spite of the fact that the weather was quite cool, if not cold. He was then improving under restricted diet.

Remarks.—I have little doubt that the factor rendering this case so amenable to dietetic treatment was the existence of a well-developed fat-forming capacity. Physiological prepotency was well marked. He lost only 7 lbs. in weight during the treatment.

CASE LXXVI.—*General eczema, complicating very advanced general rheumatoid arthritis. Complete relief of skin affection by diet. Under observation 2½ years.*

Alfred L——, aged 30.

In perfect health until August 1899. On the 3rd of that month during the night, pain began in the right ankle. This gradually increased and extended to every joint in his body. In October 1900, he became an in-patient of the Brisbane General Hospital: at that time, he was just able to walk with a stick, but was going steadily from bad to worse. His downward progress continued unchecked, and in December 1900 he was transferred to the Benevolent Asylum at Dunwich. At this time, eczema had appeared on the scalp and on the dorsum of both feet. At the latter institution, the eczema steadily spread until practically the whole of the skin of his body was affected.

August 10, 1901.—Admitted to Diamantina Hospital. He then presented the picture of the worst conceivable case of general rheumatoid arthritis. All his joints were enlarged and fixed: he was literally unable to move any portion of his frame: muscular tissue had practically disappeared; and the crucial ligaments of his knees

had been absorbed. In addition, his skin was one continuous thick scab of eczema with the exception of his neck, part of his shoulders, upper arms, and epigastrium: his feet were enormously swollen.

His pulse was very weak and soft; and he suffered frequently from violent irregularity and intermittence of the heart's action, with great praecordial anxiety. Also he suffered severe pain in both hips, shoulders, neck, and small of his back: the pain was greatly accentuated at night.

For the first month after admission, he continued to take the ordinary spoon diet of the hospital with meat once a day. During this time there was no improvement in any direction.

On September 8, 1901, he was ordered a small meat diet (ten ounces meat or fish, three ounces bread and butter, some green non-starchy vegetables, tea with milk). On this steady improvement in several directions set in. By the commencement of October, his heart attacks had quite ceased and his pulse, though still weak, remained regular and about 90. By the middle of this month, the severe nocturnal exacerbations of his arthritic pain had ceased and he slept well through the night without narcotics. The eczema also slowly abated.

At the end of November 1901, the eczema had greatly improved.

By the first week in January 1902, the eczema had disappeared from all parts except the outside of the feet, which were exposed to constant pressure. Thenceforward his skin elsewhere remained absolutely clear and healthy.

Note made in October 1903.—Skin remains healthy except on feet, where exposed to constant pressure. He has returned to an ordinary mixed diet, but takes little food in all. His joint affection is of course quite hopeless.

Note made in April 1904.—Condition unchanged.

Remarks.—In an apyrexial patient crippled to such a degree as to have lost all power of movement of the limbs, the rate of combustion must be extremely low. And unless such a one be endowed with a well-developed fat-forming capacity, it is obvious that a very moderate carbonaceous intake may be sufficient to cause hyperpyraemia. That the eczema, the cardiac irregularity and praecordial distress in this case all owned a common hyperpyraemic factor, is shown by the result of restriction of the carbonaceous intake.

CASE LXXVII.—*Eczema of face. Rapid improvement under diet.*

G. W. M.—, aged 36: weight 9 stone $1\frac{1}{2}$ lb.

For the last two years he has suffered from eczema. His nose is especially affected, being covered with one continuous scab. His cheeks, ears, neck, and chin are affected to a less extent.

He has for the most part enjoyed excellent health : he has never had any form of indigestion. A little over a year ago, he had a violent attack of 'colic' which kept him in bed seven days *without food* : at the end of this week, his eczema had completely disappeared : it rapidly returned, however, as his health returned.

On December 23, 1901, he was dieted in the usual way, sugar being cut off and starch foods reduced to two ounces daily. No local treatment of any kind.

December 26.—Eczema improved, especially left cheek.

December 31.—Left cheek well, right much improved, nose better.

January 7, 1902.—Nose is nearly healed, but remains red as if from sunburn : rest of face, etc., quite well. Weight 8 stone 12 lbs.

Subsequent history.—This was not so satisfactory. The patient lived in a western district and in a country hotel where the food was not tempting. Relapse occurred, but he is much better than originally and regards himself as convalescing gradually.

CASE LXXVIII (contributed by Dr. A. J. Turner).—*Eczema of face of three years' standing. Complete and permanent relief by diet, etc. Under observation 16 months.*

Sergeant C—, age about 45 ; height 5 ft. 8 ins.

May 26, 1902.—Has suffered from eczema of the face for last three years off and on : constant for last twelve months : he feels better when the rash is out. Appetite and digestion usually good. Pulse not high tension. Weight 12 stone 3 lbs. Urine sp. gr. 1014, no albumen.

Ordered ichthyol 3 ss. in 3 j. lanoline. Calamine lotion and apenta water.

Diet. Three meals. Toast half a round, about $6 \times 5 \times \frac{1}{2}$ inch. Meat and green vegetables.

June 1.—Some improvement in eczema. Weight 12 stone $1\frac{1}{2}$ lb.

June 21.—Much improved. Cheeks well, forehead and nose better. Feels well but hungry at times. Weight 12 stone.

July 19.—Face free, scarcely a trace left on forehead. He tells me that the eczema cleared up last July but relapsed in September. (July is the coldest month of the year in Queensland.)

December 31.—Face quite clear. A slight, very transient itchy patch on the wrist. He tells me that he has suffered now for three summers and has been clear now for the first time at this time of the year. He has made no change in his mode of life except diet, which he has kept to strictly : he never felt better. Weight 11 stone 11 lbs.

February 18, 1903.—Three weeks ago a slight return of eczema : was feeling 'tired' before it appeared but has been feeling well since. It is confined to the region round the left eye, but the skin round the

right eye has been smarting as though the rash were coming. He has never been so free in summer since the eczema first appeared. Weather since Christmas has been exceptionally hot. Weight 11 stone 6 lbs. Advised to take more exercise.

September.—Met him in Queen Street. Face perfectly clear. He is still adhering to his diet.

Remarks by the author of this work.—It is perhaps a little unfortunate for the hyperpyraemic theory that local applications were used in this case. The chief point, however, was the absence of the usual summer relapse, and this could only have been due to the alteration of diet. Eczema is more common and worse in this country during the summer heats, whether this is due to retarded combustion or sweating or both.

CASE LXXIX (communicated by Dr. Hawkes). *Eczema : renal calculus : uro-lithiasis. Convalescence from all three affections under diet.*

Charles B——, aged 50: weight 11 stone 2 lbs.

This gentleman, who occupied a good official position, had suffered for some years from uro-lithiasis on and off. He also had many of the signs of renal calculus. In addition, he had eczema of the eye-brow, forehead, and external auditory meatus. He was a great bread eater, consuming several rounds of bread at each meal.

He was put upon a diet of meat and green vegetables, his bread being reduced to three ounces a day.

The uro-lithiasis ceased in a day or two. In four weeks, all his eczema had disappeared. About six weeks after the commencement of treatment, he had an attack of renal colic: the stone (a uric-acid one) got jammed in the urethra and had to be cut out. Since then, he has been free from renal pain.

A little later, without medical sanction, he doubled the daily amount of his bread: shortly the eczema began to return: this was again dispersed by cutting down the bread to three ounces.

Remarks by the writer of this work.—The rapid disappearance of uro-lithiasis under restriction of the carbonaceous intake is common. I should however hardly have ventured to ascribe the passage of a renal calculus to the same cause, were it not for the fact that the same event occurred in a case of my own in almost identical circumstances. (Compare Case XXVIII.)

CASE LXXX.—*Acne : eczema : headaches : debility : anaemia : scanty menstruation. Relief from all the above by diet and exercise.*

Emily R——, aged 22: weight 6 stone 13½ lbs.

She is employed in a store and her hours are long: she has but

little fresh air and practically no outdoor exercise: her diet consists mainly of carbohydrate.

For some months she has been losing in weight, strength, appetite, and colour. She is now rather anaemic and the menstrual loss is very slight: her face is covered with acne, her chin with eczema, both of which eruptions become markedly accentuated pre-menstrually: she also suffers from occasional sick-headaches.

January 3, 1904.—Treatment was by diet only. Meat, fish, or eggs were insisted upon at each of her three meals: starch foods were cut down to three ounces per diem; and sugar excluded. She also had a pint and a half of milk daily.

January 9.—Acne has greatly improved, no fresh spots having appeared: the eczema on the chin is nearly well; and she has lost her feeling of weakness. Weight 6 stone 11 lbs.

January 17.—She has had a week's holiday at the seaside: has taken plenty of exercise and increased starch foods to six ounces daily: weight 6 stone 13 lbs.: eczema has disappeared.

January 31.—Well in all respects: weight 7 stone 1 lb.: is quite strong: fairly good colour: menstrual flow much freer: has had no headache since commencing treatment.

Remarks.—Such cases are extremely common amongst girls of her occupation: deficiency of physical exercise and protein is doubtless the main factor of the hyperpyrexia responsible for the symptoms.

Menorrhagia is perhaps the commonest menstrual abnormality in hyperpyrexia and is then to be regarded as a conservative means of decarbonization. But this does not apply to hyperpyrexia associated with anaemia, in which combination there is usually amenorrhoea or diminished flow. Probably the conservation of haemoglobin is a more pressing necessity of the organism than the dispersion of hyperpyrexia.

CASE LXXXI.—Acne, completely dispersed by restriction of the carbonaceous intake and exercise.

Delia M—, aged 19 years: weight 8 stone 5 lbs.

Since puberty she has suffered from acne, which becomes distinctly worse a few days before the onset of menstruation. She dislikes meat and takes very little. On the other hand, she has a good appetite for sweet carbohydrate dishes of all kinds, which appetite she indulges. She rarely suffers from indigestion.

September 29, 1901.—Ordered regular exercise: to omit sugar and all articles of food containing sugar: reduced bread to three ounces per diem; and take meat, fish, or eggs at every meal.

October 7.—The eruption has practically disappeared: weight 8 stone 4 $\frac{3}{4}$ lbs. Bread increased to four ounces daily.

October 12.—Face clear of eruption: scars left by eruption becoming anaemic. Weight 8 stone $5\frac{1}{4}$ lbs.

Remarks.—Usually acne at the age of this patient is pathologically prepotent. Though capable of much improvement by restriction of the carbonaceous intake, yet to obtain complete dispersion the restriction has to be carried to the extent of causing loss of weight. This case was an exception.

CASE LXXXII.—*Pruritus ani preceded by hay-fever, post-nasal catarrh, chronic vascular engorgement of pharynx, haemorrhages from nares and pharynx, haemorrhoids, and asthma. Rapid relief by restriction of the carbonaceous intake. Under observation 4 months.*

Dr. A. T. W—, aged 40.

He had suffered for some years from attacks of hay-fever; also from chronic post-nasal catarrh and chronic vascular engorgement of the pharynx. His symptoms were occasionally relieved by haemorrhages from the nares and pharynx. Later he contracted asthma; and later still haemorrhoids. When his haemorrhoids began to bleed his asthma ceased. The tendency to nasal and pharyngeal haemorrhage was checked by local treatment; and his piles were excised by Whitehead's method. Almost immediately after leaving the private hospital, his asthma recommenced. He then discovered a locality in which he remained free from asthma: whereupon he promptly took up his abode there. But very shortly after the cessation of his asthma, he commenced to suffer from pruritus ani. This speedily became so severe as to cause serious insomnia. He then consulted me. I advised him to exclude sugar in all forms from his diet and to reduce his starch foods very considerably, replacing them to some extent by an increase of proteid and green vegetables. The relief from pruritus was rapid. Four months later, he remained practically free, although he had resumed the use of beer at lunch and dinner, a beverage to which he had been long accustomed and without which he suffered considerably from constipation.

Remarks.—This case is a good illustration of the danger attending the relief of any pathological acarbonizing process by the mere removal of essential secondary factors, that is, of essential factors, other than hyperpyraemia. The organism sought relief alternately by asthmatic, and by haemorrhagic, acarbonization. Both 'safety valves' were fastened down in succession, the latter by surgical interference, the former by change of atmospheric conditions. The result was the development of one of the cutaneous manifestations of unrelieved hyperpyraemia. The dietetic restriction which relieved the last affection, would, I doubt not, have anticipated the whole series of hyperpyraemic affections, had it been adopted originally.

CASE LXXXIII.—*Mitral incompetency resulting from acute rheumatism: irregularity and commencing heart failure. Relief by digitalis and diet. Under observation 2½ years.*

Peter B—, aged 33: slightly built, undersized man. Ten years ago had rheumatic fever: since then has been much troubled with cardiac symptoms. Ten months ago he began to suffer from oedema of the ankles which extended halfway up to the knees.

On January 9, 1902, admitted to the Diamantina Hospital from the Brisbane General Hospital, where he had been an in-patient for two months. At the latter institution he had been on the ordinary spoon diet and had been taking digitalis. He had suffered greatly from insomnia due to palpitation and irregularity of the heart. His heart was enlarged, the apex beat being to the left of the nipple line, and there was a loud mitral systolic murmur. There was intermittence occasionally with extreme irregularity: pulse about 100, very difficult to count.

For the first month after admission his diet was unchanged, and he was ordered tinct. digitalis $\text{m}\ddot{\text{x}}$. thrice daily. At the end of the month there was no improvement. He slept in snatches throughout the day, but had hardly any sleep at night through constant palpitation and distressing cardiac sensations: pulse 100.

On February 4, 1902, he was put upon a small proteid diet with two ounces of starch foods only and a pint of milk: the digitalis was continued. In three days there was a perceptible improvement: the pulse fell to 78, and became less irregular, though still intermittent at times. Thenceforward there was steady improvement.

Note made in October 1903.—Remains in perfect comfort. There has been no oedema of the ankles for over twelve months. He takes digitalis for a week or two and then leaves it off for about the same length of time. His pulse has been down to 52; but it averages about 68 and is full and regular. He has altered his diet on a few occasions for a day or so, but has voluntarily returned to it, finding a tendency to recurrence of his old symptoms.

Note made in April 1904.—Condition unchanged.

Remarks.—This is an example of a series of cases in which appropriate acarbonizing treatment afforded marked relief in valvular disease. Hyperpyraemia, probably through causing peripheral vasoconstriction, is frequently the main factor in functional cardiac irregularity and intermittency. But the existence of organic lesion by no means gives us the right to exclude hyperpyraemia and its influence. And in practice it will constantly be found that a small mainly, but not exclusively, proteid diet has strikingly beneficial effects upon the cardiac symptoms of valvular disease. Not the least of its benefits is its power to enhance the action of digitalis.

CASE LXXXIV.—*Renal cirrhosis with long-standing headache, palpitation, and dyspepsia. Marked relief from subjective symptoms by diet and exercise. Under observation 1½ year.*

Mrs. R—, aged 65: weight 7 stone 7½ lbs.

May, 1902.—This patient had been losing weight and strength for some years: for the last twelve months she had suffered from almost constant headache day and night: the pain was general, but most severe in the occipital region. She was always more or less dyspeptic and flatulent, had occasional attacks of vomiting, and suffered from palpitation, always on the least exertion and often when in bed at night. Her skin was dry and of a sallow earthy tint. She rose two or three times each night to pass water.

There was hypertrophy of the left ventricle and marked accentuation of the cardiac second sound. Pulse 66, very high tension. Urine 1010, pale and albuminous ($\frac{1}{8}$).

She was ordered the following daily diet:—Lean meat, fish, and eggs, in all nine ounces: starch foods, three ounces: milk, two pints; also some green vegetables and one or two apples.

November 25, 1902.—She has been much better since the change of diet. Her headaches quickly abated: from being more or less continuous, they are now only occasional (about once a week) and are comparatively mild. She rarely suffers from palpitation; but the flatulent dyspeptic symptoms still occasion a good deal of discomfort. Pulse 68, high tension. Urine 1015. Albumen about the same. Weight 7 stone 6½ lbs.

Her diet was then specified as under:—

7 A.M.—Some hot water.

8 A.M.—Two and a half ounces of mince: 1½ ounce pulled bread, with a little butter.

11 A.M.—Half a pint of milk, a little diluted with hot water.

1 P.M.—Cold meat 2½ ounces: toast 1 ounce: French beans very well cooked: peaches stewed with saxon, a tablespoonful.

4 P.M.—Half a pint of milk, diluted as at 11 A.M.

6 P.M.—Mince 2½ ounces: pulled bread 1½ ounce.

9 P.M.—Half a pint of milk diluted as before.

No fluid to be taken with meals.

She was ordered to take one to one and a half mile's walking exercise every day, some of this always during the evening.

January 26, 1903.—The dyspeptic symptoms quickly abated after the last change of diet: she remained very comfortable until one week ago when the headache reappeared every morning, disappearing after breakfast. Pulse tension seems rather less. She still rises once during the night to pass water. Urine, albumen about the same. Weight 7 stone 5 lbs. She had been a little careless as to the quantity of food. No change in treatment.

August 22, 1903.—She remained very much better until seven or eight weeks ago, when her headaches began to be more severe and prolonged : they were present when she woke about 2 A.M. to pass water and again when waking at the usual time. She has had a little flatulence and dyspepsia, but not much. Her palpitation has been practically absent. Pulse 80 : tension seems less. Urine 1016, albumen about the same. Weight 7 stone 2 lbs.

No change in diet except to reduce bread at each meal to one ounce and increase the diluted milk to three-quarters of a pint. To continue exercise, especially in evening. Hot bath immediately before bedtime.

September 28, 1903.—Considerably better. She still has a trace of headache, but only on rising in the morning, and this rapidly passes off. She takes half an ounce of whisky before bedtime and sleeps well in consequence. She has no palpitation and only occasionally flatulence. Urine 1016 : albumen about $\frac{1}{8}$. Pulse is distinctly more compressible, 80. She continues to take her regular exercise.

Comparing her condition at this date with her condition sixteen months ago, there is a very marked improvement. All her subjective symptoms are much less severe and some of them have disappeared. The colour of her face has greatly changed : it is fresh and shows a tint of red : no one would suspect Bright's disease from her complexion now. There is an appreciable diminution in pulse tension (though this of course still remains a long way above normal), in diuresis and thirst. On the other hand, there has been a slight loss of weight ($5\frac{1}{4}$ lbs.) in the sixteen months ; but she was steadily losing weight when she came under treatment and probably at a greater rate.

Remarks.—This case goes to show that some of the most distressing symptoms associated with renal cirrhosis depend not, as is commonly supposed, upon uraemia, whatever the chemistry of that humoral condition, but upon hyperpyraemia, the humoral condition primarily responsible for the kidney degeneration ; and that such hyperpyraemic manifestations are capable of being held in check by acarbonizing treatment, just as in cases uncomplicated by renal degeneration. It has been pointed out elsewhere that many of the intercurrent hyperpyraemic manifestations of renal cirrhosis are more than usually amenable to acarbonizing treatment : this in all probability depends on the fact that such manifestations can rarely if ever be pathologically prepotent. (Compare Cases LXXXV and LXXXVI.) This case also demonstrates that meat—even red meat—in moderate amount, is not of necessity followed by exaggeration of any of the special phenomena of renal cirrhosis.

CASE LXXXV.—*Advanced renal cirrhosis. Marked temporary relief from symptoms by small mainly proteid diet.*

Edward S—, aged 50.

He was obviously in a very advanced stage of renal cirrhosis. He was suffering from great thirst and polyuria : dyspepsia after every meal no matter how small : insomnia and restlessness amounting on some nights to mild delirium : asthmatic dyspnoea from three to five every morning : praecordial pain and palpitation on the least movement, and at night even while at complete rest.

There was hypertrophy and dilation of the left heart. Pulse rather irregular, occasionally intermittent: very high tension. Oedema of ankles and legs as far as the knees. Urine about five pints in the twenty-four hours: sp. gr. 1010: distinct albuminous cloud.

He had been fed mainly upon soft carbohydrate milk dishes and milk.

Treatment.—He was kept for twelve hours without food of any kind, but drinking a little hot water at frequent intervals. The following daily diet was then ordered :—Proteid in the form either of minced beef or of fish or eggs, six ounces: toast fully baked one and a half ounce with a little butter: milk two pints. He did not take the full diet the first day, but gradually worked up to it in about three days.

He gradually improved. Seven days from the initiation of the dietetic change, the improvement was quite conspicuous. Dyspepsia, praecordial pain, and palpitation had ceased : so had the nocturnal asthma. He was much less thirsty. He was sleeping well through the night, arising twice only to pass water: the urine had fallen in quantity to four pints in the twenty-four hours. The pulse was now regular, beating 90, and it seemed to me that it was a little more compressible ; but of this I am not sure. The oedema had practically disappeared from his lower extremities. He was not now restless, but placid and clear-headed, and expressed himself as feeling much stronger.

The improvement was maintained for some weeks, during which he went for daily drives and enjoyed life to some slight extent. Thereafter he began slowly to go downhill and died with uraemic symptoms about three months later.

Remarks.—When I first saw this case, there can be little doubt that many of his symptoms were manifestations of hyperpyraemia, not of uraemia. This was true at least of the nocturnal asthma (which never recurred even when uraemia had set in) and probably of the dyspepsia. His cardiac symptoms were doubtless due to incipient heart failure ; and the result of treatment strongly suggests that hyperpyraemia was a factor in the responsible vaso-constriction

of the periphery. The case should be read in conjunction with Cases LXXXIV and LXXXVI.

CASE LXXXVI (communicated by Dr. Hawkes).—*Renal cirrhosis with long-standing asthma. Complete relief from the latter by diet. Under observation 3 years.*

James MacD —, aged 60: weight $15\frac{1}{2}$ stone.

This patient suffered from renal cirrhosis, manifested by all the typical symptoms, such as nocturnal polyuria, slight albuminuria, high blood-pressure, hypertrophy of the left ventricle, etc.: he also suffered very frequently from nocturnal and diurnal asthma: this affection was of some years' duration.

He was put upon a diet consisting mainly of lean meat, fish, and milk: his starch food was limited to bread, and this to one half-round at each meal.

For nine months after the commencement of the treatment, he remained absolutely free from asthma: thereafter, he suffered occasionally, but only after departing from the diet-scale, or after alcohol. There was no increase of albuminuria under the altered diet.

Remarks by the author of this work.—There is a tendency to regard asthma associated with renal cirrhosis as uraemic: this tendency is naturally accentuated when the asthma is a late complication of the kidney disease; nor are we justified in denying the existence of a uraemic asthma. But many asthmas complicating even the latest stages of renal cirrhosis are certainly hyperpyraemic, as can be shown by the effect of acarbonizing treatment. The probability is that the majority of 'renal asthmas' are late manifestations of the hyperpyraemia which was the primary factor in the renal degeneration. In the present case the asthma was a comparatively early co-expression.

It has been pointed out that asthma arising in such circumstances cannot possibly be pathologically prepotent, but must be the opposite. Hence probably its amenability to acarbonizing treatment. (Compare Cases LXXXIV and LXXXV.)

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